

**White Papers for: *“Toward Zero Deaths: A
National Strategy on Highway Safety***

—White Paper No. 1—

**FUTURE VIEW OF
TRANSPORTATION:
IMPLICATIONS FOR SAFETY**

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PREFACE

While many highway safety stakeholder organizations have their own strategic highway safety plans, there is not a singular strategy that unites all of these common efforts. The dialogue began towards creating a national strategic highway safety plan at a workshop in Savannah, Georgia, on September 2-3, 2009. The majority of participants expressed that there should be a highway safety vision to which the nation aspire; even if at that point in the process it was not clear how or when it could be realized. The Savannah group concluded that the elimination of highway deaths is the appropriate goal, as even one death is unacceptable. With this input from over 70 workshop participants and further discussions with the Steering Committee following the workshop, the name of this effort became “Toward Zero Deaths: A National Strategy on Highway Safety.” The National Strategy on Highway Safety is to be data-driven and incorporate education, enforcement, engineering, and emergency medical services. It can be used as a guide and framework by safety stakeholder organizations to enhance current national, state, and local safety planning and implementation efforts.

One of the initial efforts in the process for developing a National Strategy on Highway Safety is the preparation of white papers that highlight the key issue areas that may be addressed as part of the process. Vanasse Hangen Brustlin has prepared nine white papers on the following topics:

1. Future View of Transportation: Implications for Safety
2. Safety Culture
3. Safer Drivers
4. Safer Vehicles
5. Safer Vulnerable Users
6. Safer Infrastructure
7. Emergency Medical Services
8. Data Systems and Analysis Tools
9. Lessons Learned from Other Countries

Experts in these areas were retained to prepare these papers. The authors were challenged to be thought provoking and offer strategies and initiatives that, if implemented, would move the country towards zero deaths.

In this first paper, a national expert in travel behavior, Alan Pisarski, teams with a national expert in highway safety programs, Dr. Forrest Council to predict how changes over the next 15 to 20 years in demography, vehicles, freight movements and other factors might affect highway safety without intervening countermeasures. The paper explores changes in the age distribution, household formation, vehicle ownership, labor force size and characteristics, and also includes the nature and structure of our economy, the movements of freight and its interactions with passenger travel. Beyond that there are prospective changes in public policies that seek to respond to national concerns for energy, security, green house gas emissions and sustainability. Producing outlooks and forecasts for the future in such an environment is fraught with multiple challenges — challenges that our

society has faced before and succeeded in meeting. The movement Toward Zero Deaths in this environment is a great challenge but achievable with effective management, effective programs and appropriate resources.

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Principal Investigator

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INTRODUCTION

Transportation is a key element in the lifestyle of the U.S. The ability of people to move themselves from place to place and the ability to move resources to manufacturers and products from manufacturers to consumers are critical elements of not only our economy, but also our lifestyles. Over the next 15-20 years, the US will likely undergo perhaps its most dramatic demographic changes since the nation's birth. If transportation can be understood as the collision of demography with geography, with the leavening of technology and economics added in, then these demographic, economic and lifestyle changes will result in significant changes in transportation and travel behavior. A byproduct of transportation is traffic crashes and the resulting injuries and deaths that result. A byproduct of the changes in travel behaviors over the next 15-20 years will either be increases or decreases in the level of safety on our roads.

Efforts to reduce crashes and the resulting harm have been ongoing for decades with notable success. As shown in Table 1 and in Figure 1, since 1995, vehicles miles of travel have increased steadily until 2007, decreasing slightly in 2008 and 2009. Even given this increasing trend, the number of fatalities per year has stayed somewhat constant between 41,500 and 43,500 from 1995 to 2006, decreased slightly to 41,259 in 2007, and then decreased significantly to 37,261 in 2008 and 33,963 in 2009. Even during 2008 and 2009 when VMT decreased, the percentage decrease in fatalities was much greater. The total number of crashes has also followed a pattern similar to that of the fatalities, decreasing slightly across the years. When the 2008 data (i.e., the latest year that all three indicators are available) are compared to the 1995 data, VMT is 20.8 percent higher, crashes are 13.3% lower, and fatalities are 10.9% lower.

Table 1. Annual counts (or estimates) of fatalities, vehicle miles of travel, crashes, injured persons and Gross National Product (1995-2009)⁽¹⁾.

Year	Fatalities	Crashes (1,000)	Injured Persons (1,000)	VMT (Billions)	GNP (billions)
1995	41,817	6,699.4	3,465.3	2,422.7	10,134.8
1996	42,063	6,769.6	3,483.3	2,485.8	10,327.0
1997	42,013	6,624.1	3,347.6	2,561.7	10,498.7
1998	41,501	6,334.6	3,192.0	2,631.5	10,615.3
1999	41,717	6,279.0	3,236.2	2,691.1	10,768.8
2000	41,945	6,393.6	3,188.8	2,746.9	11,003.5
2001	42,196	6,322.9	3,032.7	2,797.3	11,267.5
2002	43,005	6,316.0	2,925.7	2,855.5	11,464.2
2003	42,884	6,328.0	2,888.6	2,890.5	11,708.2
2004	42,836	6,181.0	2,788.4	2,964.8	12,044.6
2005	43,510	6,159.0	2,699.0	2,989.4	12,433.9
2006	42,708	5,973.0	2,575.0	3,014.1	12,826.5
2007	41,259	6,024.0	2,491.0	3,029.8	13,087.0
2008	37,261	5,811.0	2,346.0	2,925.7	13,232.0
2009	33,963	na	na	2,932.4	12,857.0

na = not available

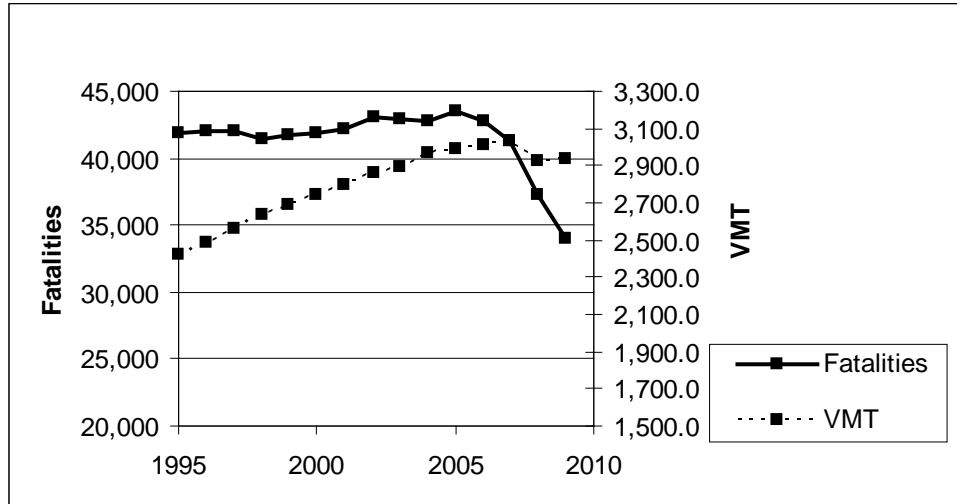


Figure 1. Graph. Annual fatalities and vehicle miles of travel (1995-2009).

These data showing that fatalities and crashes have not increased with VMT indicate that safety programs have played an important part in the present level of success. These and other data have demonstrated success in driver programs¹ (e.g., occupant restraint use, DUI programs), roadway treatments (e.g., rumble strips, median barriers) and in vehicle design (e.g., airbags, rollover prevention). Treatments in all three areas have affected both the number and the severity of crashes.

However, much still remains to be done. Traffic crashes still continue to be the leading cause of death for ages 5-34, the leading cause of unintentional injury death, (i.e., 36% of all injury deaths in 2006), the leading cause of quadriplegia and paraplegia, (i.e., 42% of spinal cord injuries in 2006), the second leading cause of traumatic brain injury (i.e., 20%), and the second to only falls in injury-related emergency room visits. In 2008, before the current economic downturn, we were still seeing approximately 37,000 fatalities, 2.3 million injuries and a societal cost of over \$250 billion.

Given the recognition of this problem, many highway safety stakeholder organizations have their own strategic highway safety plans. All States have a Strategic Highway Safety Plan. However, unlike many other developed nations, there is not a singular strategy – a national strategic highway safety plan, that unites all of these common efforts. This is now changing. A national

¹ Note that in this document, the terms “safety programs,” “treatments” and “countermeasures” are used interchangeable to depict safety-related actions implemented to reduce crash fatalities and injuries.

consortium of safety-related organizations² has begun the development of a highway safety vision that the nation can aspire to – “Toward Zero Deaths: A National Strategy on Highway Safety.” The National Strategy on Highway Safety will be data-driven and incorporate education, enforcement, engineering, and emergency medical services. It can be used as a guide and framework by safety stakeholder organizations to enhance current national, state, and local safety planning and implementation efforts. The initial part of this effort is the development of a series of nine white papers that will outline the key issue areas that may be addressed as part of the process for developing a National Strategy on Highway Safety. This is the first of those whitepapers.

SCOPE OF THIS WHITEPAPER

As noted above, the level of safety on our roadways and changes in that level, as measured by crash deaths and injuries, has multiple causes. In general, the level of safety is a function of exposure to crashes (i.e., how much driving, walking, biking), of crash risk given exposure (i.e., who is driving, what vehicle they are driving, how safely they are driving and how safe the roadway is on which they are driving), and by injury risk given a crash (i.e., user vulnerability, vehicle design, protection system use, roadway protective systems). Some of these factors are not under the control of the “safety community” (e.g., the economy, travel behavior), while others can be affected by specific actions of the safety community (e.g., the development and implementation of safety treatments). With one exception, this initial whitepaper will examine the first group of these factors – those not related to specific treatments. The one exception will be a discussion of future safety management under a Zero Death goal – what changes will be needed, who will be the managers and what tools they will need to use. The subsequent whitepapers will concentrate on factors which can be affected by safety treatments, identifying promising and proven treatments in numerous areas and estimating their potential cost and effects for the future.

The factors that will be examined in this paper will include:

- Demographics
- Licensing and vehicle ownership
- Travel behavior and activity
- Freight growth (specifically how highway freight growth will affect vehicle fleet)
- Sustainable transportation
- Roadway safety management

² The steering committee includes representatives of the American Association of State Highway and Transportation Officials, American Association of Motor Vehicle Administrators, Commercial Vehicle Safety Alliance, Governors Highway Safety Association, International Association of Chiefs of Police, National Association of County Engineers, National Association of State Emergency Medical Services Officials, Transportation Research Board, Federal Highway Administration, National Highway Traffic Safety Administration, and the Federal Motor Carrier Safety Administration.

For all but the final topic – Roadway Safety Management – the paper will attempt to predict, to the extent possible, the changes that might be expected over the next 20 to 30 years. It will then attempt to predict how each change could affect the level of safety on our roadways. Thus, we are attempting to predict what will occur *without a substantial change in the number or type of safety treatments that will be implemented*. In effect, this is what we would expect to see under a “business as usual” safety policy. The remaining whitepapers will then explore the “better business” scenario – how best to make the substantial treatment-related changes that will be necessary to move toward a zero-death goal.

We note that predicting what is likely to occur with each of these non-treatment factors over the next two decades and what effect such changes might have on safety is difficult. Predicting future changes is always difficult, but as will be shown in later sections of this paper, there are data to draw from. However, there is no existing body of research relating changes in non-treatment factors to changes in fatalities and injuries.

Figure 2 below is based on the data in Table 1 above and presents annual percentage changes from the 1995 base year data. Each of the variables shown in Table 1 is graphed here. As can be seen, between 1995 and 2007, both VMT and GNP increased each year while fatalities stayed fairly constant or increased slightly and crashes and injuries decreased. As perhaps expected, there does seem to be a relationship between VMT and GNP (a measure of economic growth).

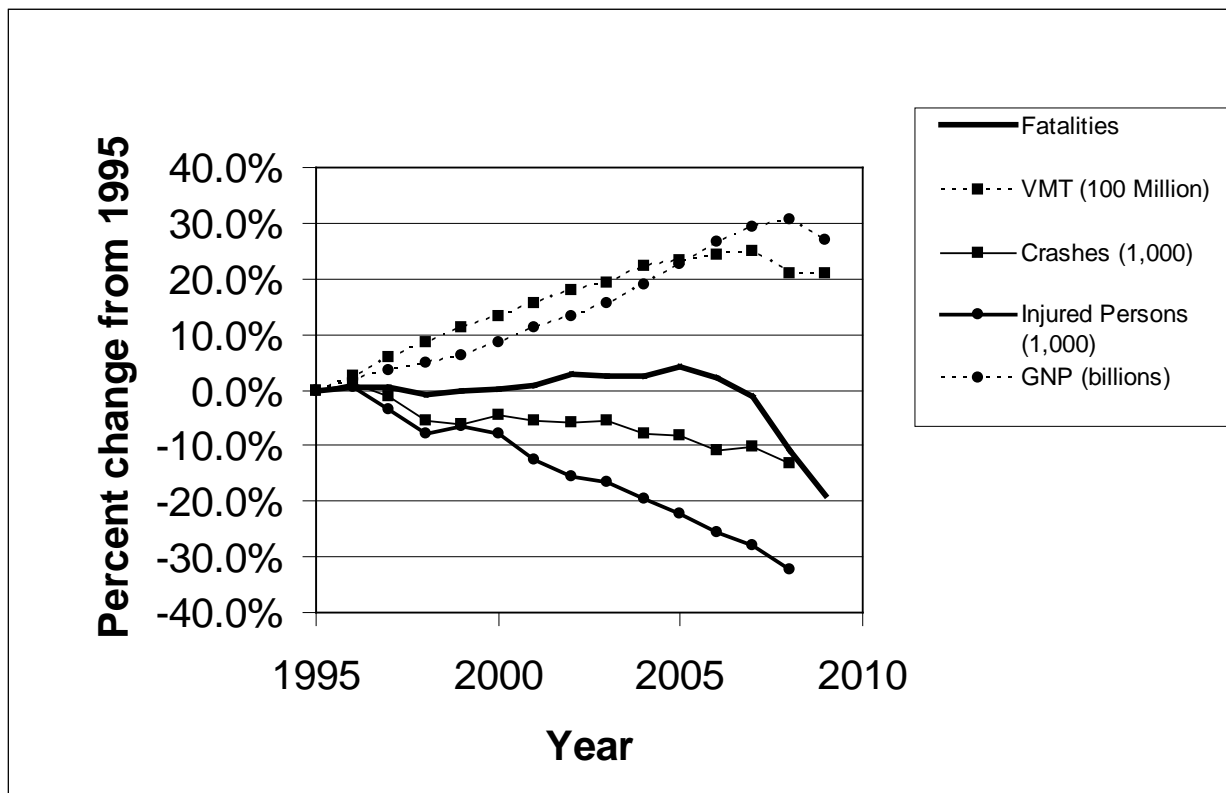


Figure 2. Graph. Annual percent changes from 1995 base data for fatalities, VMT, crashes, injured persons and Gross National Product (1995-2009)

In the absence of all safety treatments, fatalities, crashes and injuries would be expected to increase with increases in VMT (and thus GNP). However we are seeing that even with the growth in VMT between 1995 and 2007, fatalities stayed constant (or increased slightly) and crashes and injuries decreased. This difference in trends would be assumed to be a result of safety treatments, stability of demographics of users, and other unmeasured factors. In a sense, these factors are “overcoming” the effects of the growth in VMT. In 2008, VMT decreased while GNP increased (in contrast to the earlier stable relationship between the two) and the percent decrease from the 1995 base in the three crash measures was even greater. In 2009, GNP decreased from 2008, VMT stayed constant, and the only crash measure that is available – fatalities – decreased even more. Indeed, as shown in Figure 3, the fatality rate per 100,000 VMT, which was thought to perhaps be bottoming out in 2005 or 2006, experienced very large percent decreases in 2008 (6.5 percent lower than in 2007) and 2009 (9.1 percent lower than in 2008). Clearly, some of this decrease resulted from the changes in VMT (related to the economy), but the decrease in fatalities is much greater than the decreases in VMT or GNP. The authors are not aware of any substantial increases in the numbers of safety programs implemented in 2008 or 2009 (e.g., significantly more driver or roadway safety treatments than in the preceding years, major changes in vehicle design). These larger decreases must be related to changes in driver exposure or behavior that we have not witnessed before (e.g., perhaps larger reductions in driving by elderly driver who are fatality injured more often or young drivers who experience more crashes per mile driven, perhaps relatively more driving on lower speed roads, perhaps changes in speeds, etc.) At this point, we are unsure of the reasons.

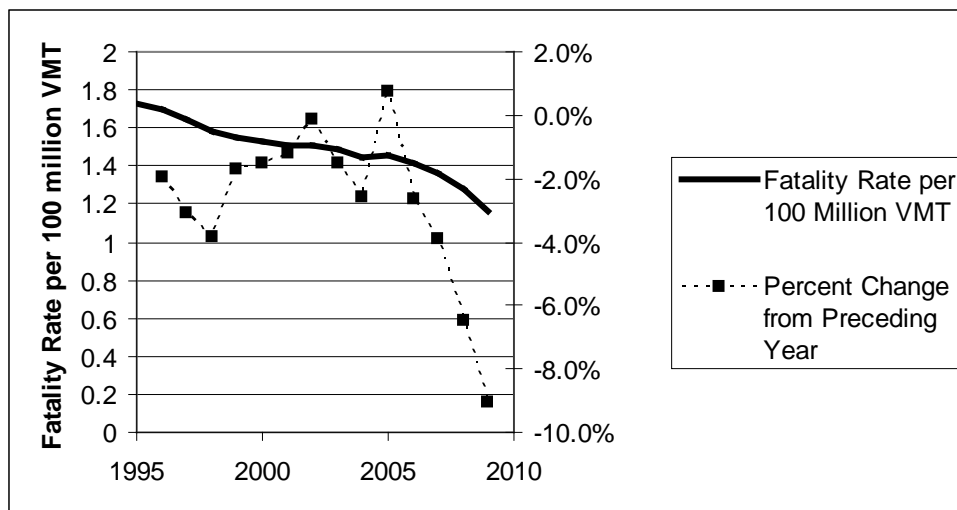


Figure 3. Graph. Fatality rate per 100 million VMT and percent change in rate from preceding year (1995-2009)

The difficulty is that these somewhat confusing patterns do not provide us with a good basis for predicting future changes in fatalities, injuries and crashes based on changes in VMT and the economy. It is difficult to predict what will happen if the economy rebounds

and begins a trend upwards – will the crash measures continue downward as they did in the 1995 – 2007 period while VMT was increasing, or under a “safety business as usual” scenario, will a minimum crash rate be reached followed by an upturn? Unfortunately, we do not yet know when such a “bottom” will be reached – at what point will the effects of the current level of safety treatments and the current user demographics, vehicle fleets, and other factors not be great enough to overcome the effect of increasing VMT?

The purpose of this introductory discussion was to provide safety, travel and economic data as background for future predictions and also to make clear the probable impreciseness of predictions of how future changes in non-treatment measures will affect future crash measures. However, this paper will attempt to make such predictions. They will be based on the opinions of the authors. It is hoped that even with the uncertainty, these estimates will provide some information on the expected level of safety under a “business as usual” scenario, and thus some information on what decreases must result from the safety treatments to be covered in the remaining whitepapers if we are to move toward a “Zero Death” goal.

DEMOGRAPHY IS DESTINY

If it is true that “Demography is Destiny” then America’s destiny will be strongly and unclearly driven in the next 20 years in ways that are unparalleled in our history. There are immense forces at work affecting the economy, the society, and the resulting travel behavior and safety of the nation, which will be playing out in the 2010-2030 period and beyond. A few of the forces are clear and effectively inexorable, others are far more uncertain and subject to actions taken and not taken as we move through the coming decades.

The one absolutely inexorable factor that drives much of the impending change is the aging out of the baby-boom generation. The first of the boomer generation hit 65 this year and many more will follow in a tide that will play out finally with the last of the boomers reaching 65 around 2030, the end point of the focus of this study. Who will replace them as they will move off center stage as the mainstay of the labor force is a very fraught puzzle filled with questions and uncertainties. One factor that might have seemed inexorable in the past but is no longer, is that those who will be twenty in America in 2030 have been born this year, but given the massive potential influx of immigrants the number of 20 year olds that will be here in 20 years is open.

So much of our cultural, economic, social and safety experience will be driven by the nature of the labor force that this demographic treatment will examine the age structure in three main groups – the young (pre-labor force); the population of labor force age itself; and the post-labor age groups. Figure 4 shows the relative scale of the three groups and the scale of their growth.

A number of points arise quickly from even a brief perusal of the data:

- Population growth is not substantial in the period; growing roughly 1% a year, as it has for the last two or three decades. Even at this rate the nation adds the population of Canada each decade. A total change in population from 310 million to 373 million by 2030 adds about 63 million.

- Half the total increase in the period is in the post-labor force group, those 65 years and over, with massive impact on travel and travel safety.
- The pre-labor force group, increases at less than the 1% a year average, adding under 13 million in the period. Population estimates for this age group will be doubly affected by immigration, both in the numbers of immigrant arrivals of that age and also the higher birth rates among immigrants already here.
- The largest group, those of working age, adds only about 19 million, with a very low growth rate of about half the average –only about 10% over two decades. Therefore, questions arise about how the labor force will function to serve the economy, and how it will be able to support a very large, particularly older, dependent population and how that all might affect travel behavior.

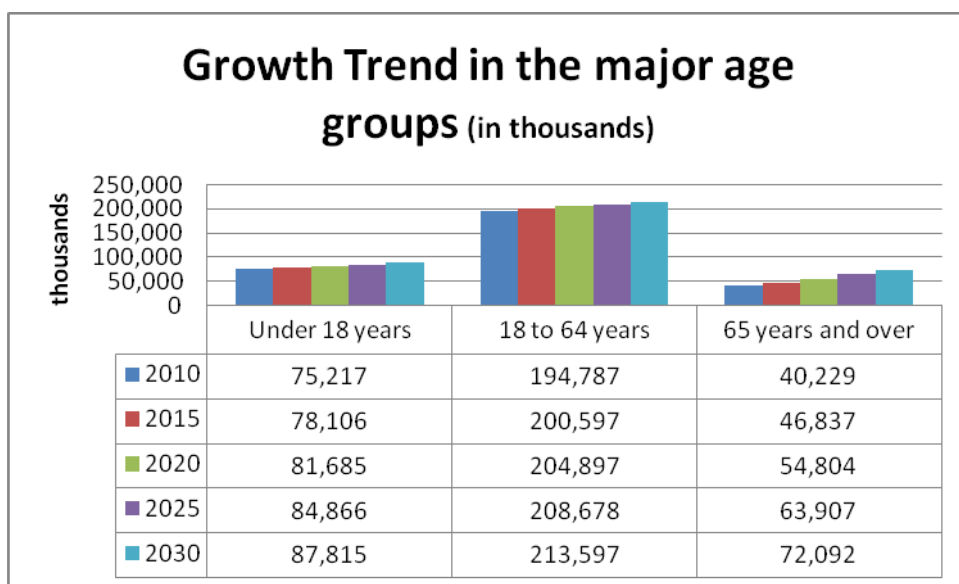


Figure 4. Graph. Growth Trend in Major Age Groups.

THE PRE-LABOR FORCE AGE GROUP – 18 AND BELOW

The younger population grows slowly throughout the period with the greatest growth among those 5-13 years of age. This suggests increases in trips where the driver is serving the needs of passengers within households and increases in school trips of about 18%, to serve almost 7 million additional children, for the period. The group most likely to be of licensing age, 14-17 years of age, grows even slower and rises from 37.1 million in 2010 to only 43.8 million, a minor increase of 6.7 million. The slower growth rate for this age group should reflect positively on fatality statistics.

To more specifically address the potential licensing group, Figure 5 shows the number of young arriving at the age of 16 through the period. The pattern appears somewhat erratic³ with growth in the decade from 2010 to 2020 showing an absolutely stable share of the

³ It appears that adjustments were made after the 1990 census given the unexpected surge in immigrants that affect projections in each year after, affecting the number of 16 years in 2006 for instance.

population at about 1.3% per year after running to highs of 1.4% to 1.5% in 2006 and 2007, in the first decade of the century. As a result, the population of about 4 million 16 year olds in 2000 added about 0.27 million by 2010 and then about 0.25 million by 2020, (that is we will add fewer 16 years olds in this decade compared to the last), but then surges by 0.43 million in the 2020-2030 decade, reaching about 5 million by 2030, and then the level of increase drops again thereafter. This all indicates that the advent of new drivers through normal population age progression will be limited, but does not recognize the arrivals of many immigrants in their early licensure years, which must be treated separately.

Overall, as discussed further below, this group will be sharply defined by the number of immigrants in this age category arriving in America, as well as the higher birth rates among the immigrant population.

Safety Implications

The relatively moderate levels of increase in this group indicate continued required support in terms of “serve passenger” travel by parents, school travel and related safety programs, but little necessity for massive expansion of those programs to support significantly larger groups. The dependence ratio grows only moderately, a 6.6% increase, in the review period, despite the weak growth in the working age group. Even with increases in effective safety programs aimed at this group (e.g., graduated driver licensing), the effect on the overall level of fatalities and injuries should be small. Increases in programs such as GDL could lead to decreases in fatalities and injuries for this group. The question of the ethnic and cultural components of the group in terms of immigrants will require significant focus on specialized groups.

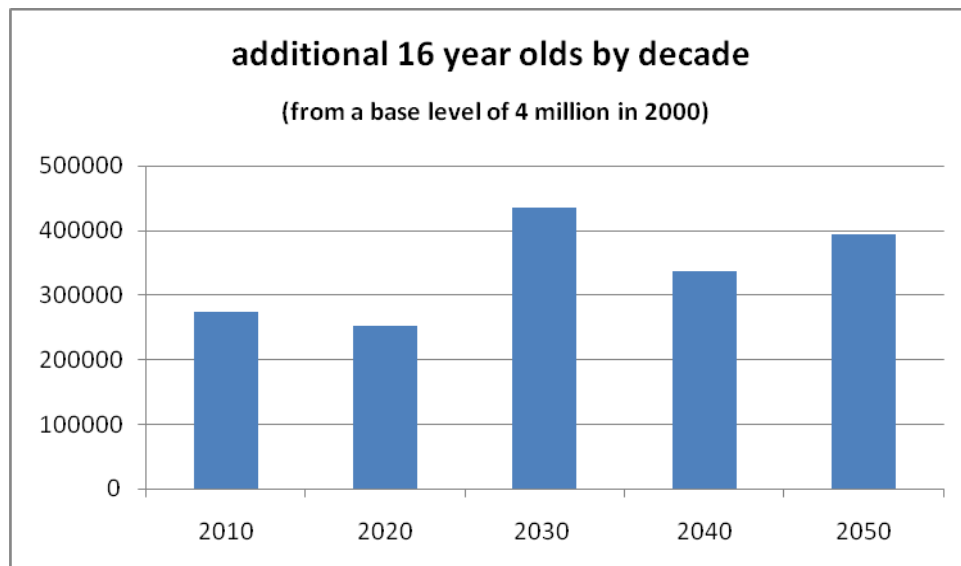


Figure 5. Graph. Additional 16 year olds by decade.

THE LABOR FORCE AGE GROUP – 18-64 – SUPPORTING THE NON-WORKERS

The central societal issue regarding the growth of the labor force age group is: “will it provide the number of workers and the skills necessary to sustain a growing and prosperous society?” The best simple measure of the reality of the situation is that we added more than 20 million persons in the 18-64 age group from 2000 to 2010 and will add fewer than that (18.8 million) in the two decades between 2010 and 2030. This will occur despite the expected significant growth in immigrants. According to the age specific projections of the Bureau of the Census the numbers of persons of ages from 50 to 56 today are projected to actually decline during the period. Many of the other age groups in the mid-40s and late 50s have insignificant growth rates. Overall the 45 to 64 year old age group is projected to only increase by about 3.3 million over the 20 years. There will be major effects, including:

- The working age group will become younger as the last of the baby boomers, who are in the older segment of the group, ages out of the work force, with an accompanying decline in experience and skills
- More women will have to be drawn into the work force than the already existing high levels
- More immigrants will be needed to sustain the economy and the general economic level
- The dependency ratio (the ratio of those who do not work because of their youth or age to those in their working years) will increase dramatically, sharply affecting life styles and incomes
- More workers preparing to retire will be sought to remain at work or begin new careers.

These factors need to be more fully examined in terms of their travel and travel safety implications.

Safety Implications

The shift to a slightly younger age structure in the labor force group could indicate some reduced growth in vehicle travel, given that the younger workers tend to be less single occupant vehicle oriented than those in the later years of their working life. This slight reduction in VMT could result in fewer crashes, injuries and fatalities (see discussion of crash rate “bottom” in Introduction). More women in the actual labor force, if that is one of the ways the society meets its worker needs, has implications for mode choice (fewer two wheeled vehicles, e.g.). Table 2 shows that women’s choice of mode to work has grown closer to men’s, but that there are still differences. The percentage of women who chose a bicycle to work was 30% of men’s in 1990 and has risen by 2008 but only to 40%. Also note that women are now slightly more likely than men to drive alone to work.

Table 2. Mode share ratios.

RATIO OF WOMEN'S WORK MODE SHARE TO MEN'S	1990	2008
DROVE ALONE	97%	102%
CARPOOLED	103%	91%
BUS OR TROLLEY BUS	166%	130%
SUBWAY OR ELEVATED	121%	111%
RAILROAD	77%	83%
BICYCLE	30%	40%
WALKED	106%	97%
WORKED AT HOME	130%	109%

Women, at this time, tend to be in occupations where their start times are later than men's and their trip lengths are shorter. More women at work will mean more time pressures on women multi-tasking and trip chaining to cover family needs and job responsibilities and a further shift to the personal vehicle where time control and personal autonomy is greater. There is little current data on *crash* risk per mile driver for women versus men. There is data on *fatal crash risk*⁽²⁾ – women's rate is approximate half the rate for men up to age 30, approximate 33 percent lower from 30-59, and approximately equal to the male rate for age 60 and over. If women account for a larger share of the VMT, this could reduce the fatal crash risk. In addition, if women trips are less likely to be by motorcycle or bicycle, crashes involving women should be less severe than crashes involving men. Shorter trips could also be lower-speed trips, with a positive effect on safety.

Retaining workers in the labor force after their traditional working years are past seems almost a certainty with immense safety implications to be discussed in the next section. The change in the worker status of those over 65 shown in Figure 6 will be central.

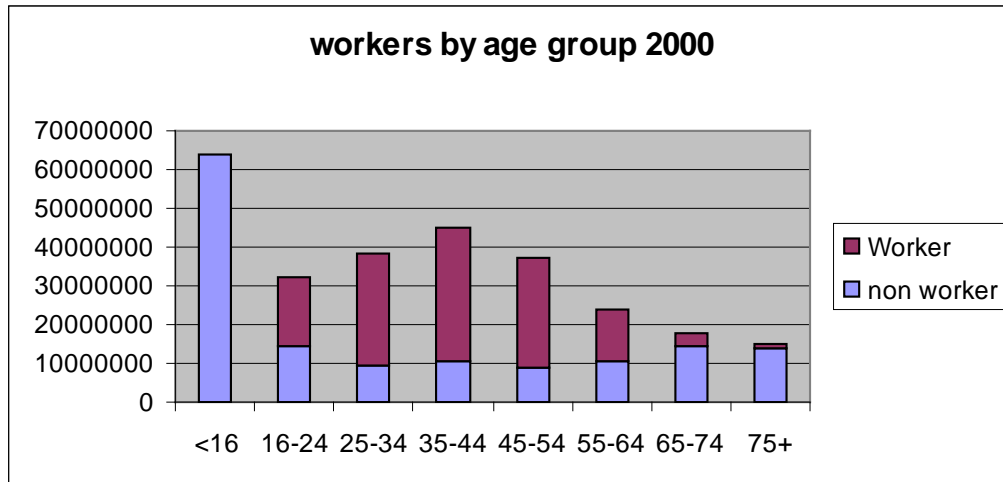


Figure 6. Graph. Workers by age group in 2000.

THE POST-WORK YEARS AGE GROUP – 65 AND ABOVE

The aging of the baby-boomers is a very clear part of most people's understanding of the dynamics of the nation's demographic structure. Figure 7 strongly emphasizes that, indicating that more than 45% of population change in the period will occur in the growth of the early post work years group (65-84), as well as another 5% by the over 85 group. In contrast with the younger age group the dependence ratio of the older population grows by 60% in the period. A pertinent footnote is that the overall dependency ratio (basically 83 persons to be supported for every 100 in the work force years) is not dramatically different from the levels when the baby-boomers were babies in the fifties, but what will be dramatically different are the needs and the focus on their needs at this end of the age spectrum. One might consider that instead of taking their kids to the dentist they will be taken to the dentist by their kids, as one illustration.

The great issues are twofold:

- To what extent will society require, and their own needs require, the post-work years group to stay in the work force?
- To what extent will the abilities of the aging population to meet its own mobility needs diminish – in what ways and at what rate?

In terms of traffic safety these may be the central demographic questions of our generation.

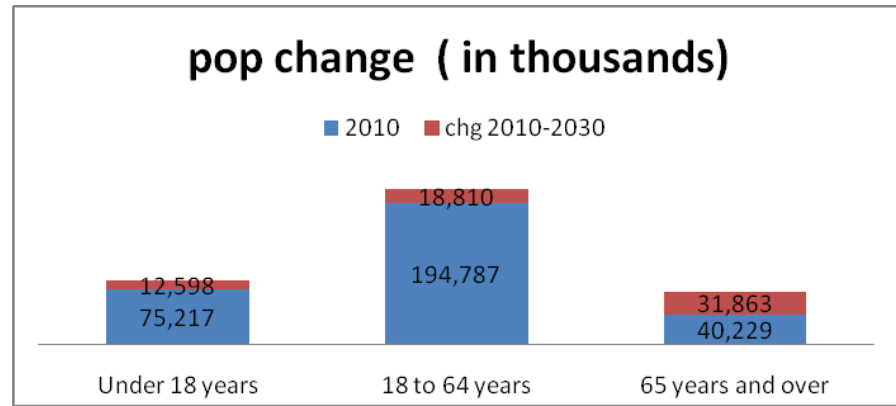


Figure 7. Graph. 2010 population and population change by 2030 by age group.

Table 3 seeks to place at least a lower bound on the possibilities for the scale of over 65 workers. The first part of the table shows that the number of workers over 65 has grown by 33% in this decade – three times the growth rate of the number of persons over 65. The share of those over 65 who are at work has grown from about 11% in 1990 to over 12% in 2000 and at 14.5% in 2008. Adopting a value of 15% for the share of those still working over 65, and accepting current Census projections of the population, yields lower bound estimates of about 8 million workers over 65 in 2020 and 11 million by 2030. This should be considered a reasonable lower bound estimate of the workers over 65 for the period. That is, at a minimum, roughly double the present level by 2030. To set a possible upper bound on the growth, given present conditions of health and technology, a simple trend extrapolation of the share rate would place the estimated share of those over 65 at work by 2030 at closer to 18% -- putting the worker group over 65 as high as 13 million by 2030. Given that the great majority of those over 65 in this period will be those just arriving at that age level it is possible to see such levels met or exceeded.

Table 3. Total population, workers and share at work for 2000, 2008, 2020 and 2030.

<u>OVER 65</u>	<u>2000</u>	<u>2008</u>	<u>growth</u>	<u>2020</u> <u>projected</u>	<u>2030</u> <u>projected</u>
POPULATION (millions)	35.0	38.8*	10.9%	54.8*	72.1*
WORKERS (millions)	4.25	5.66*	33.2%	8.2^	10.8^
SHARE AT WORK	12.1%	14.5%		15%^	15%^

*Census Bureau estimates and projections

^ author's estimate

Safety Implications

What more needs to be said than that there will be a doubling of workers over 65 in the period and almost a doubling of the over 65 population. Given the higher licensure rates of the coming bulge the increase in drivers should exceed a doubling. This will be the first generation to have come to maturity in the modern auto era. The present group of women over 65 is the last to have such low levels of licensing. Figure 8 delineates the picture. Licenses are held by about 70% of those over 85, with men about 10 percentage points above the average and women the same amount below. But the group just now arriving at 65 averages just over 90% with a dispersion of only three percentage points between men and women. Thus for women there is almost a 30 point shift from below 61% to about 89%. The groups just behind the 65 year olds who will reach that age by 2030 have only a slightly greater share with licenses of about 3 percentage points greater among men and women. Further work to assess the extent to which past decays in license holding after 65 have changed the patterns over time and whether that might pertain more or less to future generations needs further consideration. One important factor is that it is projected that men's longevity will increase in this period and their higher than average license holding will be a factor.

Again, there is little clear evidence concerning crash rates per mile driven for elderly drivers versus middle age drivers. Limited evidence might suggest that the rate increases at age 75 and above. There is clear evidence that older drivers (70 and above) are more likely to be killed in a given crash than younger drivers (the "frailty factor")⁽²⁾. Thus, even in the absence of higher crash rates per mile, increases in driving by this group will be expected to increase the number of fatalities. And as indicated above, unlike in the past when the elderly driver self-limited the number of miles they drove, this would not be expected to be the case in the future, particularly given pressures on them to continue in the work force.

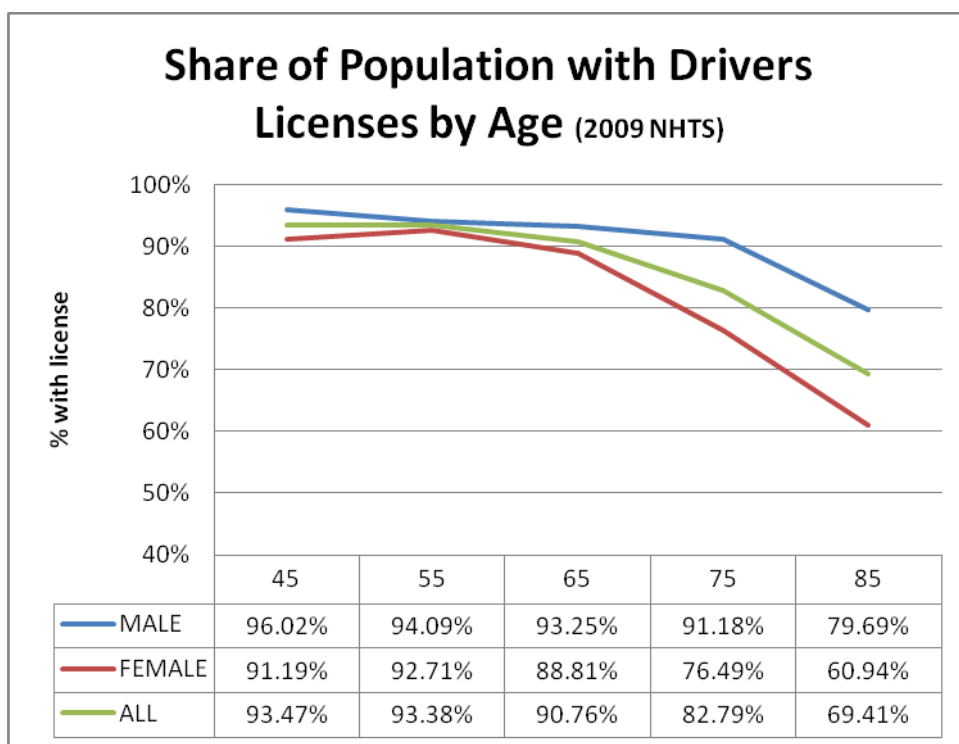


Figure 8. Graph. Share of population with drivers licenses by age.

OTHER DEMOGRAPHIC FACTORS

Household Size

Since the baby boomers began coming of working age in the sixties American household sizes have been on a long decline. Figure 9 traces the decline in household size from 3.37 in 1950 to a low of 2.59 in 2000. Current levels have risen back into the 2.6 range as the economy forced some families to reunite their members to ease living costs. As in most cases averages can be deceptive. Here the case can be made that America will see a mixed set of opposing trends: increasing family sizes as Hispanic immigrants, with a greater tendency to have large families, become a bigger part of the nation’s child-bearing households; and, increasing numbers of one person households as the aging boomers lose their partners. The contemporary tendency for the young to postpone marriage and family formation further complicates these trends.

Throughout the last 60 years, at least, household sizes have been declining and as a result the number of households has been growing faster than population. This has significant implications for travel and safety.

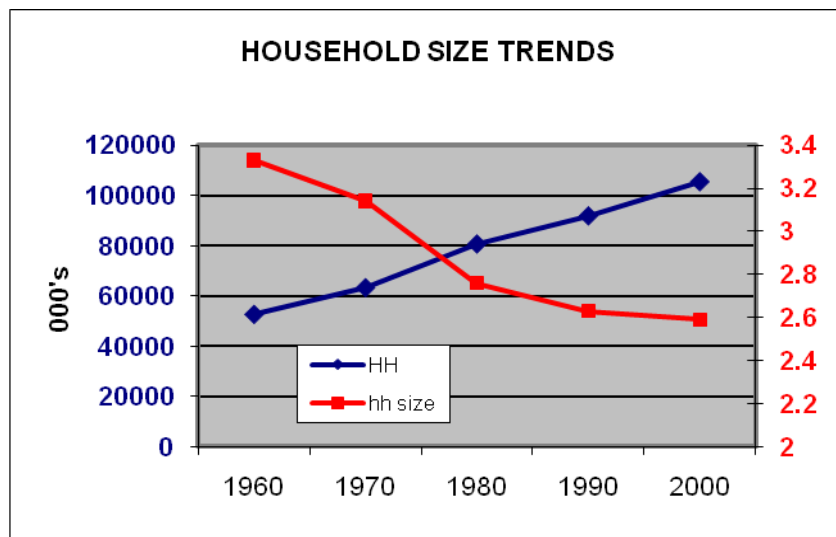


Figure 9. Graph. Share of population with drivers licenses by age.

Safety Implications: It is often households that drive trip-making based on basic family needs. Many aspects of travel – incomes and vehicle availability – are more household attributes than personal attributes. It could have been expected that decreasing household sizes would affect housing choices regarding renting and smaller unit sizes, but it appears that the effect has been the opposite. Smaller family units have permitted more spending on household goods such as larger facilities and vehicles. This all conduces to more travel than the same population in fewer households. It means more serve passenger trips of the young but possibly with lower vehicle occupancies than would derive from larger families.

More travel per household would be expected to increase VMT and thus to increase crashes in general. If more of the trips are low-speed trips with less occupancy, crash severity and the number of injuries may be lower. Given all the uncertainties, one would expect this factor to have a minimal effect.

Immigration Factors

While much of demographic development can be seen as quite stable and in some ways inexorable, with components of change that shift very slowly over time, the wild card in these patterns in America today is certainly immigration. It can change with the stroke of a pen in Washington and change as our borders are crossed legally, or not, by those seeking what America offers. The sharp reductions in Southern border crossings in the last two years, due to the decline in job availability in the US, are but one example. Figure 10 depicts the expectations from the Census Bureau in 2008. It shows natural increase declining as births grow (14%) but deaths grow faster (28%) in the period. At the same time international immigration increases steadily until a cross-over point is reached around 2027 where total increase is generated more by immigration than natural increase. This actually understates the impact of immigration in that a major part of natural increase will be generated by those same immigrants having children. Note that total population

increase in 2050 is estimated at 3.45 million per year only slightly more than in 2030 or 2010 which indicates a very sharp decline in annual growth in percentage terms from just about 1% in 2010 down to .79% in 2050.

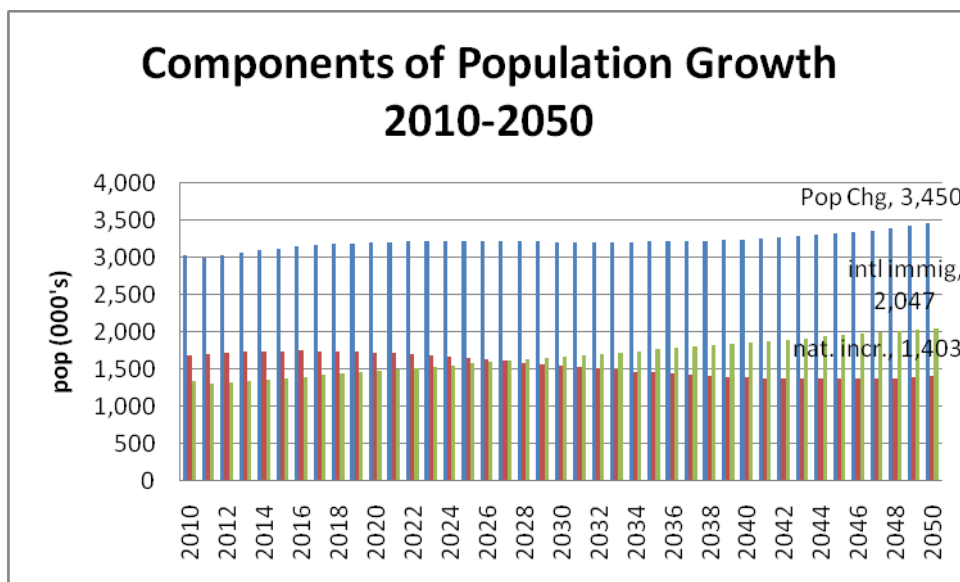


Figure 10. Graph. Components of Population Growth, 2010-2050.

A key transportation factor regarding immigration is the age of immigrants. Fundamentally the arrivals are of working age and constitute a major part of worker increase in the period. Of the approximately 11 million immigrants arriving in the 1990-2000 period, over 8.5 million were in the working age group 18-64.

Safety Implications: The key point here is that immigrants frequently become an immediate addition to commuters so births cannot be the basis for estimating future workers. New immigrants begin their work careers here with heavy emphasis on carpooling, walking, bicycling and transit. Hispanic immigrants in particular have been a major source of carpooling increases in the South and Southwest. Over the years they shift away from these modes to patterns more typical of the total population. In their early stages – the first five or ten years – they are a major factor in transit usage. This has significant impact on modal choice as immigrant workers move through a progression of modes over their working years, and a greater increase in auto travel eventually than simple birthrates would indicate. It means a focus on jobs, cars and homes – that’s why they are coming. There is a secondary factor that must be examined and that is what cultural tendencies toward driving and traffic the immigrants bring. Those who arrive, never having had a drivers license in their home country at least learn the traffic rules here, but those who may have driven in their home country can have disparate behaviors and expectations, even as pedestrians than other populations – both other immigrants and the local population.

Indeed, there is essential no data on crash or fatality rates per mile driven for different racial/ethnic groups. Data on fatality rates per 100,000 population indicate that Hispanics have approximately the same rate as Whites and African-Americans.⁽³⁾ However, this rate does not account for possible differences in miles driven by the groups (which currently are large differences). The same report indicates higher percentages of alcohol use by Hispanics in fatal crashes and fatal pedestrian crashes than for Whites. This higher indication of risky driving might lead to conclusion of possible higher crash rates per mile for Hispanics. If that is true, then the increase in at least Hispanic immigrants might ultimately lead to an overall increase in crash rates and higher numbers of fatalities and injuries. The more difficult to answer question is what effects will result from the differences in “driving cultures.”

LICENSING AND VEHICLE OWNERSHIP

There are changes occurring in the acquisition of drivers licenses among the young that are significant, but that are difficult to assess in terms of whether they are related to current issues or are harbingers of longer term trends. Figure 11 clarifies the question. There has been a sharp decline in licensing within the early licensing years since some time after 1997. Some have seen this as an indicator of the “digital generation’s” disinterest in mobility, with the notion that their cell phones are substitutes for travel. There may be partial validity in this as a cultural factor but there are other factors in play that are readily identifiable such as:

- Arrival of graduated drivers licensing (GDL) beginning around 1997, as a growing factor in most states’ rules for licensing.
- Advent of young immigrant workers likely to be at the lowest rung of the economic ladder.
- Limited growth in the past decade that has restrained, or reduced, incomes of the lower income segments of the society.
- Massive persistent unemployment among teenagers, 38% in May 2010.
- High insurance rates for younger drivers.

Despite these patterns overall licensing which dropped slightly after 1997-1998 had returned to historical levels by 2008.

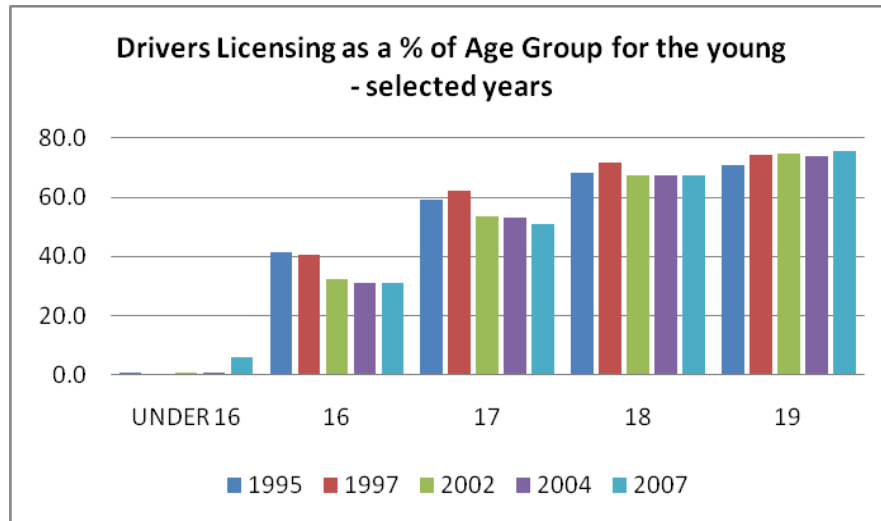
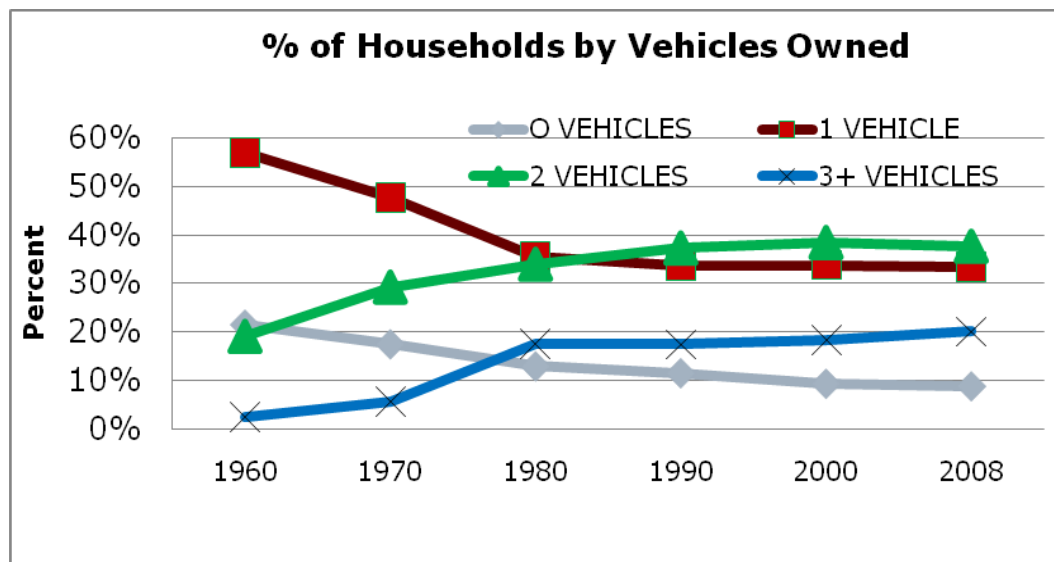


Figure 11. Graph. Driver licensing as a percent of age group for the young – selected years.

America’s long term trend in vehicle ownership has reached some degree of stability as illustrated in Figure 12. Since 1980 the shares of households stratified by vehicle ownership has remained relatively stable with households without vehicles remaining notably around 10%, slowly declining over decades. One vehicle households have exhibited similar stability at just above 30%. In fact, these two groups have had almost constant levels of the population with about 10 million households without vehicles and about 30 million with one vehicle. Effectively all of the change in vehicle ownership had occurred in the two and three vehicle households until an uptick in one vehicle households. An assumption that these shares will remain relatively stable over the next 20 years would indicate that vehicle ownership would grow only at the rate of household growth.



Note: 2008 data are not wholly consistent in design or time interval with the long term trends based historically on the decennial census but do indicate a continuation of stability.

Figure 12. Graph. Percent of households by vehicles owned.

Another factor that needs consideration is the long term trend in vehicle ownership among minorities. Figure 13 shows that African American households have been on a sharp path of reducing the share of households without vehicles over time, down from about 43% in 1970 to the range of 20% in 2007. Hispanic households exhibit a similar trajectory from a smaller base indicating that both Hispanics and African Americans could reach a level very similar, if not identical, to White Non-Hispanic households by 2020, or early thereafter. Basing future analyses on that assumption seems warranted both from an analytical and a social equity perspective.

SAFETY IMPLICATIONS

The fundamental reality to consider here is that America will never see again the dramatic levels of increase it saw in the last century regarding the growth in autos. Fundamentally we are at saturation with growth coming from three sources: the arrival of youngsters at driving age; the growing incomes of minority populations, and immigrant arrivals. This indicates growth in travel activity that is perhaps less complex and less difficult to address in both traffic

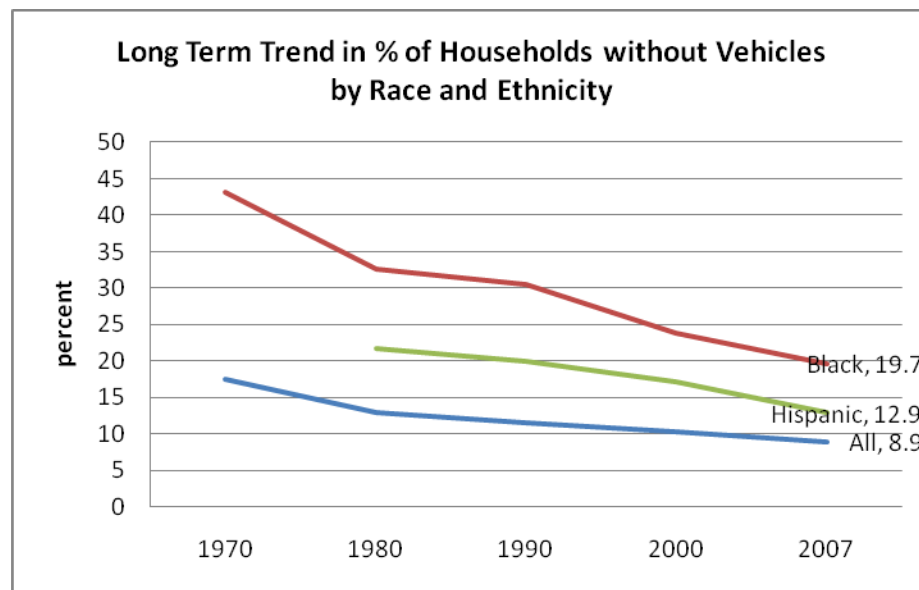


Figure 13. Graph. Long term trend in percent of households without vehicles by race and ethnicity.

management and safety terms. This stability also indicates that the age of the vehicle fleet, exacerbated by the recent economic downturn, continues to grow – now averaging about 9 years – and therefore the ability to replace the massive national fleet with newer, safer, more efficient vehicles takes close to two decades.

Thus, in general, one would expect a decreased rate of licensing for 16-17 year olds to continue. Given that these drivers tend to have higher fatality (and probably crash) rates per mile driven, this could decrease the number of crashes, injuries and fatalities. The trend toward more vehicle ownership per household for Hispanics and African-Americans could increase overall VMT, and thus perhaps increase crashes, fatalities and injuries. Finally, the longer vehicle fleet replacement cycle could result in more crashes and more severe crashes per mile, assuming that new cars will continue to add both crash-reducing and injury reducing technologies.

TRAVEL BEHAVIOR AND ACTIVITY

FUTURE ECONOMIC ACTIVITY

This study cannot perform an independent economic forecast, rather it adopts for utilization the long standing forecasting processes employed by the Department of Energy (DOE), for their annually produced Energy Outlook,⁴ which incorporates population and employment trends, energy prices and technological changes. It provides in a single

⁴ In this case, the *Annual Energy Outlook 2010* produced in December 2009

consistent framework both economic projections such as GDP and transportation estimates such as VMT.

While our present economic condition and levels of activity are filled with doubts and uncertainties, any longer term assessment must be based on resumption of longer term trends in economic productivity and output. Assumptions about continued high unemployment and low economic activity are neither useful nor sustainable. Key elements of our future pertinent to understanding the prospective safety context are presented in Figure 14, showing population, employment, GDP per capita and VMT estimates through 2035. The growth levels are significant. Population is estimated to increase by .9% a year, employment by .8%, GDP by 2.4%, and VMT by 1.7%.⁵ It is notable that in this series employment does not return to 2007 levels until 2013. Both GDP/capita and VMT are closely aligned and are projected to increase by approximately 44% by 2030. The levels of expected GDP/capita identified here would seem to assure that future auto ownership levels, as discussed earlier, can be realized financially.

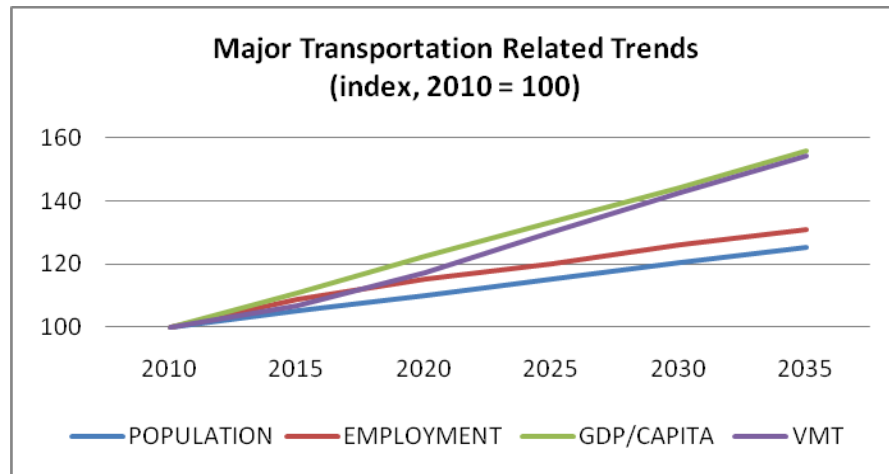


Figure 14. Graph. Major transportation related trends.

HOUSEHOLD SPENDING FOR TRANSPORTATION

American wealth is most notably a product of multiple workers per household. The Consumer Expenditure Survey indicates that the wealthiest 20% of households average four times as many workers as the poorest 20%. It is workers per household that drive transportation activity and transportation spending. Figure 15 shows that having a worker in a one person household more than doubles transportation spending and in multi-person households each additional worker adds around \$3,000 in transportation spending. So it has been workers per household that has driven transportation activity and transportation spending.

⁵ The 1.7% estimate is consistent with overall trends in this decade prior to the recession. It is to be noted, however, that AASHTO forecasts for the 2009 *Bottom Line* Reauthorization report to Congress placed expected growth levels closer to 1.4%.

There is in fact a four-way linkage between working, incomes, vehicle ownership and spending as depicted in Figure 16 below. The five groupings represent the lowest to highest 20% of households stratified by income. In all household groups the average number of vehicles exceeds the average number of workers. In one worker households 93% of households have one or more vehicles; in two worker households 87% have two or more vehicles; and in households with three or more workers 74% have three or more vehicles. Moreover of the 10% of households that are vehicle-less about 60% have no workers in the household.

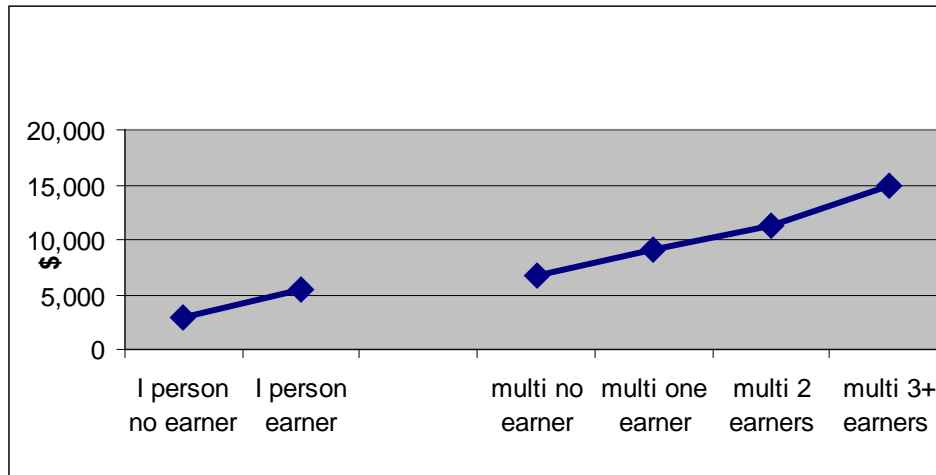


Figure 15. Graph. Household spending for transportation by number of workers in the household.

Not only does transportation spending rise with increasing income, as expected, but the percentage of household spending that is devoted to transportation rises with incomes up until the highest brackets, thus as our society becomes more affluent it can be expected that transportation spending will rise at least proportionately to income supporting the acquisition of vehicles, and greater travel activity.

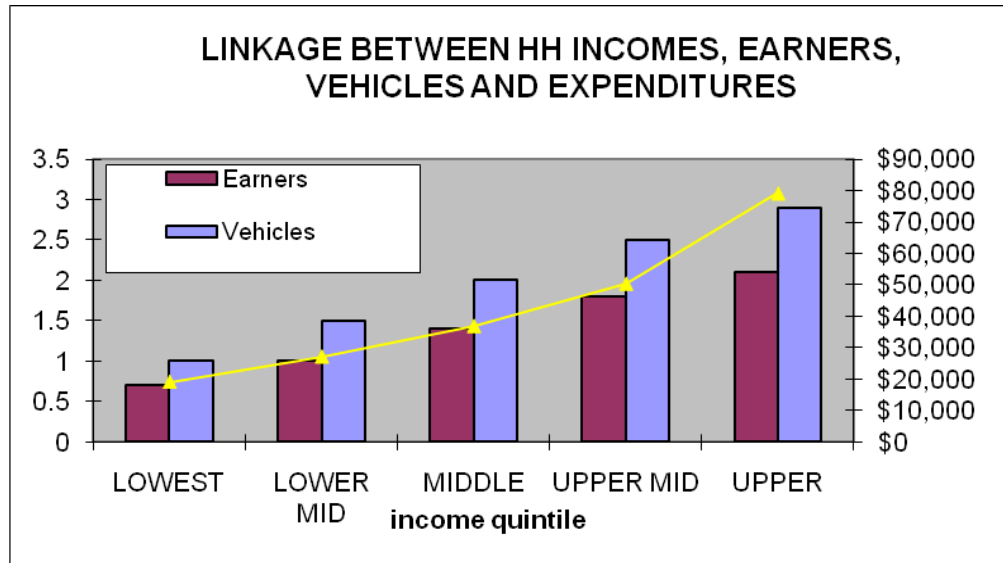


Figure 16. Graph. Linkage between household income, earners, vehicles and expenditures.

As noted earlier, increases in income generate increases in travel. While much of the increase in long distance travel is air oriented, 95% of all personal miles traveled PMT daily ground travel is via personally operated vehicles (POV). The increase in VMT with income therefore is still significant, as shown in Figure 17 below. With incomes slated to grow by about 44% from 2010 to 2030 that would put the average household income in the \$70,000 range in the chart rather than in the \$40,000 to \$50,000 range at present; or in effect raising per capita VMT from the 8,500 mile range to more like 10,000 miles.

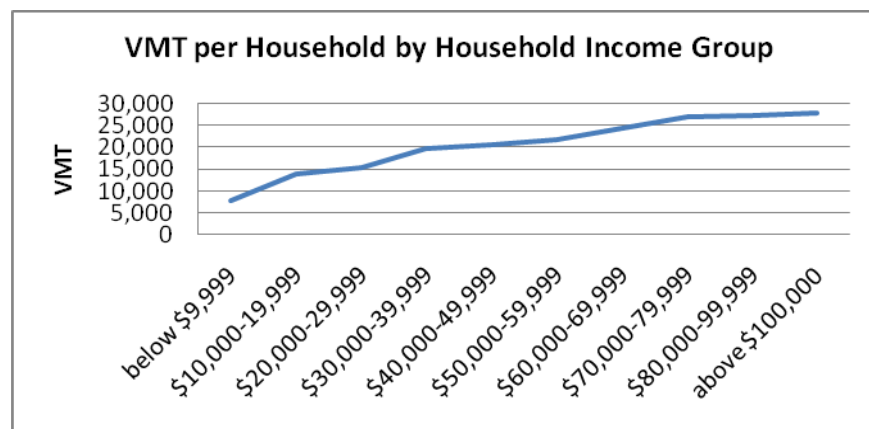


Figure 17. Graph. VMT per household by household income group.

LONG DISTANCE TRAVEL

The 2009 NHTS indicates that more than a quarter of all person VMT occurs at distances greater than 50 miles. This should be taken as a minimum level given that neither the focus nor strength of the NHTS is in long trips. Note in Figure 18 that the 2001 and 2009

trip length frequency distributions are fundamentally identical, indicating substantial stability in the distribution. The 1995 ATS, the most recent survey specifically directed at long distance travel, similarly indicated that more than half of all PMT occurring above 300 miles in round trip distance were by private vehicle. Using that survey for a better source of purpose distributions of private vehicle travel indicates in Figure 19 that it is only in business travel that the use of a private vehicle drops off sharply with distance, but even there the majority of trips are in private vehicles for trips under a thousand miles round-trip.

Unfortunately, future long-distance travel is difficult to predict. If economic growth increases in the future (as expected), then one might expect an increase in long-distance leisure travel by older drivers.

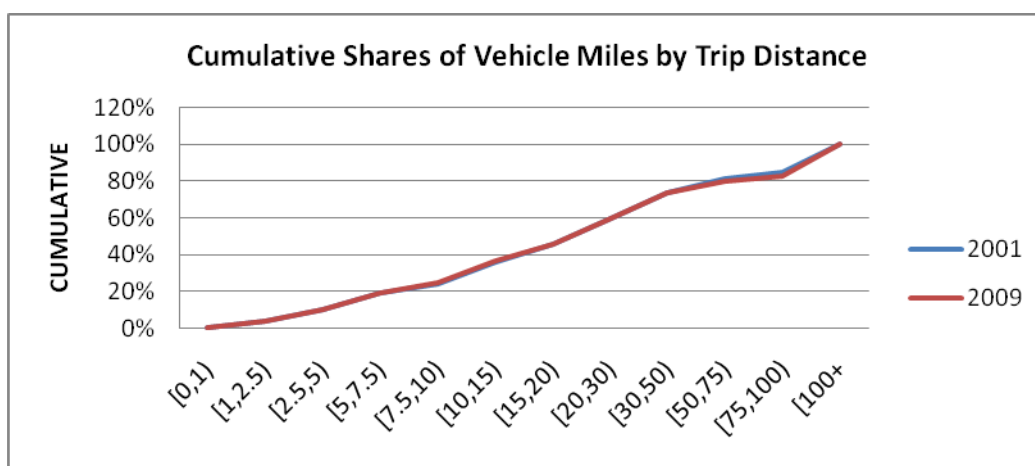


Figure 18. Graph. Cumulative shares of vehicle miles by trip distance.

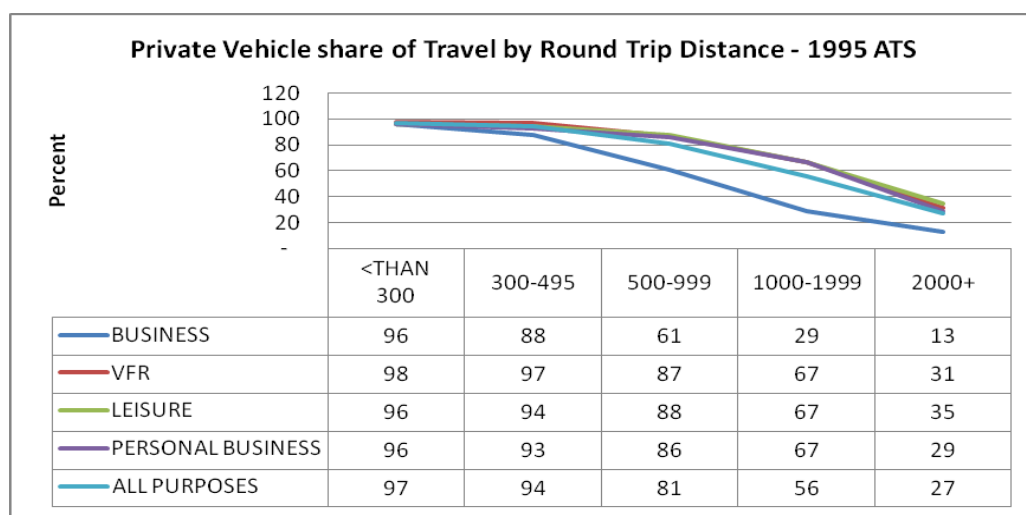


Figure 19. Graph. Private vehicle share of travel by round trip distance (1995 ATS).

HOUSING AND LOCATION PREFERENCES

There are views about prospective trends in housing that have two main elements: the first is that the rapid growth in one person households and reductions in households with children will reduce the number of single family homes, leading to more apartment living by young persons living alone as well as retirees; and the second is that as part of that trend there will be a resurgence in urban living and growth in center cities. While there are certainly aspects of these concepts that have validity there is little in the way of current data to support the broader assumptions involved.

A look at the share of one person households, shown in Figure 20, over the last decade and a half indicates that the share of those one person households under 30 has actually declined from around 13% to 11% (although their numbers grew substantially) as a result of growth in one person households in the working age groups. Interestingly, the share of those one person households over 65 also shrank most particularly those from 65 to 74, sometimes referred to as the depression baby generation, notably for its small size.

It was the baby boomer generation of single person households, from 45 to 64, which expanded dramatically from 25% to 36%, that affected all of the estimates. As this age group reaches retirement over the survey period of 2010 to 2030, the key question will become what will they do about housing – move toward regional centers, seek smaller units in their present location or simply age in place? Indications have been for the last 20 years or more that aging in place is the most likely action, not a certainty, but that as a planning assumption it seems most supported by evidence.

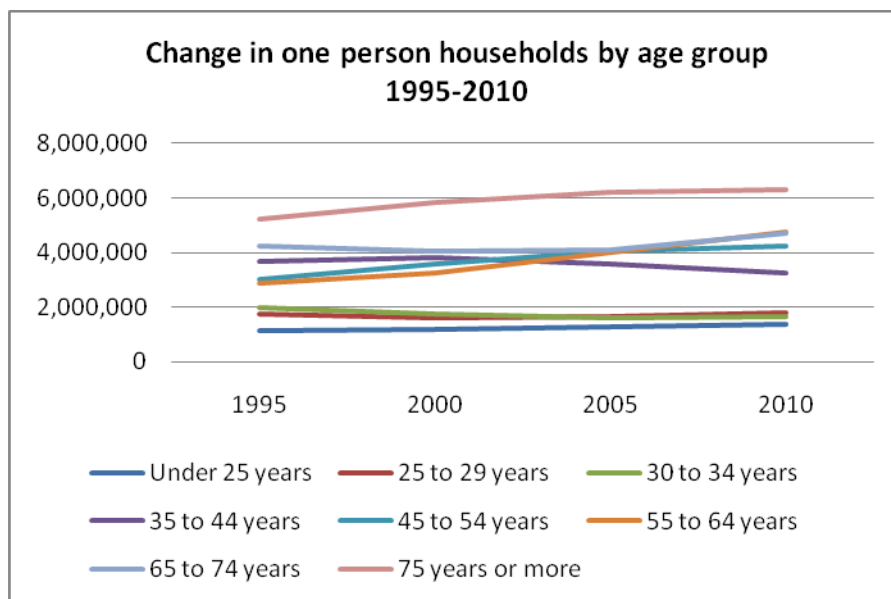


Figure 20. Graph. Change in one person households by age group, 1995-2010.

There is validity in that the number of households with children as a share of all households has declined since 1970 but most of that occurred between 1970 and 1980 – what has changed is the marriage status of those with children.

Abetting the aging in place observation is that migration trends continue to support the preferences for suburban life styles. Domestic migration has slowed perceptibly as a result of the recession and the resulting housing mortgage and job problems, reaching the lowest levels since such patterns began being observed by the Bureau of the Census.

As the housing and job markets improve it can be expected that past trends will resume their previous levels. To understand why, it is important to examine the reasons given for moves and where people go when they move.

Most moves may be job related⁶ – new job (5%), looking for work (3%), or relate to household changes such as marital status change (5%) or establishing a household (9%). Housing related choices are significant such as wanted own home (5%), new or better apartment (14%), better neighborhood (5%). Pertinent to transportation interest the main factor relating to being closer to work or having an easier commute is about 5%. Retirement as a cause of moving is less than 1%, suggesting that aging in place is the reality, at least at present.

Care is needed in examining where people go when they move. In the 2008-2009 period about 37 million people moved, but about two thirds (25 million) of those only moved within the same county, so that segment showed little to indicate major shifts in preferences re urban life-styles. Among movers beyond county borders about 4.8 millions left principal cities⁷ for suburbs while 2.6 million left suburbs for principal cities. Those moving from non metro areas to metro areas also showed a preference for suburbs. Only foreign immigrants showed a slight preference for cities but far less than had been true in past decades, as more and more immigrants arrive directly to suburban areas. Overall, metro areas gained about 300 thousand from non-metro areas with principal cities losing about 2.1 million, while suburbs gained 2.4 million. Again, the trend is to suburban living.

In 1960 the Census counted 34 areas over a million in population; by 1990 it had reached 39. We now have 52 areas with populations over one million accounting for more than half of the nation's population. Within that group the 12 areas of over 5 million together account for a third of the nation's population and received roughly a one-third share of the nation's population growth in the current decade. These are the areas with the nation's greatest congestion and traffic issues, where many road safety issues will be centered.

It is difficult to assess the prospects for growth in metro area size. With the abrupt shifts in growth rates in recent years, in such boom areas as Las Vegas, Phoenix and Orlando, the only areas that seem to be continuing at their past growth pace at present are those of Texas. It is not unreasonable to assume that the national trend toward the South and West

⁶ Continuing Population Survey 2008-2009

⁷ Principal City is a recent Census term which not only includes the traditional central city of a major metropolitan region but also can include significant cities in the suburbs. So the statistical discussion here significantly understates the suburban preferences.

will continue the patterns of the last 50 years, without the feverish pace and overbuilding seen in recent years. But overall it is safe to assume that the nation will be increasingly metropolitan, increasingly large metropolitan and increasingly large metropolitan suburban (as opposed to central city).

At the same time, it is important to note that the nation's non-metropolitan areas, with about 20% of the population, is certainly not evacuating, with significant growth in selected areas. There are rapidly growing smaller areas, often keyed around major recreation areas and national parks, which will attract large population growth in percentage terms, particularly among retirees. The nation's population will be increasingly footloose with jobs keyed to services that do not need significant resource bases or transportation hubs to sustain them. The freedom generated by services and the demand for skilled workers indicates that many workers will be freer to live where they wish and the work will follow them.

SAFETY IMPLICATIONS

The expansion in the number and scale of large metropolitan areas indicates that future trips for work and other purposes are likely to increase in length. Unless massive congestion curtails travel potential, or major public policies that cause people to move away from suburbia are enacted and successful, people will take advantage of the array of job opportunities, living opportunities, and social/recreational opportunities afforded by the scale of the areas in which they live. This may be critical to economic success in a highly specialized economic environment where workers will have to be drawn from larger and larger commutersheds. Given that most workers live in multi-worker households, a pattern which is likely to continue given economic trends, opportunities to live near work for most workers will be limited. Most job growth is in the suburbs of these large metro areas which will increase the potential for fringe population growth and suburb to suburb commutes which is already the largest single commuting pattern. Within the suburban context there will be opportunities for more dense concentrations in clusters of jobs and residences which will permit growth in walking and biking travel where feasible. This could mean more vehicle/pedestrian interactions with accompanying safety concerns. The overall growth in larger metropolitan areas and the aggregation of the national population in these areas should mean greater opportunities for new transit facilities and support for older systems. It could also mean greater strains on aging infrastructure of both highways and transit.

This pattern of increasing VMT, with many of the trips being in or between suburban areas would be expected to increase crashes. The severity of the crashes might be lessened if the majority of the trips are at lower speeds. However, there are likely to be a significant part of the between-area trips that are at higher speeds and not on Interstates, increasing severity.

TRUCK FREIGHT

THE PRESENT AND FUTURE SCALE OF TRUCK MOVEMENTS

The highway system provides the major part of freight movement in America. It accounts for about two thirds of the tons moved and almost 75% of the value shipped both at present and, according to estimates by FHWA,⁸ out to 2035, as shown in Table 4. These percentages are for domestic movements alone. When imports and exports are added the total amounts shipped, in tons and value, rise, especially in the future years. As a result, the road share declines given the greater roles of water and rail in international movements. Intermodal movements, involving more than one mode, and often involving trucks such as in airfreight movements, grow substantially in the period. For trucking, it is estimated that by 2035 tonnage moved will grow by approximately 75% and value shipped will more than double. In general, as the value of goods increases the tendency to use truck increases where possible, as shippers of higher value goods place greater value on the reliability and control provided by trucking. An AASHTO report⁹ estimates that by 2020 there will be an additional three billion tons of freight moved by truck, and another 1.8 million trucks on the road. By 2030 they estimate that there will be a third truck on the road for every two out there today. This is consistent with the DOE estimates of a 62% increase in VMT by 2030 among large (over 10,000 lbs) trucks, whereas light trucks are expected to grow slightly less with a 50% increase.¹⁰ Thus, it appears that truck VMT growth will be approximately the same or perhaps slightly higher than passenger car VMT growth.

Table 4. Freight tons and value.

	DOMESTIC FREIGHT			
	2007		2035	
	TONS	VALUE	TONS	VALUE
ALL	19268	12363	33667	29590
TRUCK	12691	9266	22230	21654
% TRUCK	65.87%	74.95%	66.03%	73.18%

Tons = Millions of Tons

Value = Billions of Dollars

⁸ Freight Facts and Figures 2008, Nov. 2008, Office of Freight Management and Operations

⁹ Unlocking Freight, July 2010, AASHTO

¹⁰ Annual Energy Outlook 2010, Dec 2009, DOE

These trends indicate slight decreases of about 9% in the amount of tons moved per dollar of GDP between 2007 and 2035 for both truck and total tonnage, to be expected in an increasingly service oriented economy; but also indicate substantial growth in the range of 36% in tons moved per capita for both trucks and total tonnage, likely a product of expected increasing wealth, international trade and energy usage.

There are also changes in the flows of goods that make projections about future flows unreliable and suggest that great flexibility will be needed in safety responses to truck volumes. For example, the shifts of auto production related traffic from the Mid-West to the South and to Mexico has changed patterns sharply over the last twenty years. The rise of China and the Asian Tigers shifted trucking patterns toward the West coast. The opening of a widened Panama Canal in the coming decade will restructure patterns again. Thus, future truck-related safety treatments will need to be targeted to these new-pattern roads.

That part of freight flows that are hazardous materials movements by truck will continue to be crucial to safety concerns. Table 2 provides a sense of the scale of activity in the trucking industry. It indicates that more than 2 billion tons of hazardous materials were shipped in 2002,¹¹ with 53% of it by road. If pipeline shipments of petroleum products are excluded the share by road jumps to 75%. It is pertinent to note that truck shipment distances are short, averaging about 105 miles, with a significant difference in trip length between for-hire and private carriers. For-hire carriers tend to be short distance haulers, averaging 86 miles, while private carriers haul longer distances, averaging 285 miles. In contrast, railroads, which carry only about 5% of hazardous movements by tonnage, haul them almost 700 miles on average, therefore accounting for 22% of the ton miles. Unfortunately, the authors were unable to find data on how hazardous-material VMT will change in the future. The best prediction may be that it will increase approximately the same as overall truck VMT.

Table 5. Hazardous Materials Shipments 2002.

	TONS	VALUE	TON MILES
ALL	2191	660	327
TRUCK	1160	420	110
% TRUCK	52.94%	63.64%	33.64%

Tons = millions of tons

Value = billions of dollars

Ton Miles = billions of ton miles

¹¹ More current information for 2007 should be available later this year from the 2007 Commodity Flow Survey

Safety Implications

It is clear that the role of trucks in the economy and the road system is extensive and growing. To the extent that trucks are a factor in road safety that will grow in proportion to their vehicle miles of travel without some significant safety actions. Even if truck VMT increases no more than total VMT, if the truck crash rate per mile were to stay constant the number of truck-related fatalities and serious injuries would be expected to increase. Indeed, because truck crashes are more severe, the relative increase will be greater than in non-truck crashes. A second key concern is that the pressures for larger vehicles and the productivity they can provide will challenge the skills of the driver labor force, which today numbers about 3 million. There have been acute shortages of capable drivers and the high levels of expected growth in this area could introduce less skilled drivers into the fleet. If this occurs, the truck crash rate per mile might be expected to increase, again resulting in higher levels of fatalities and serious injuries.

HIGHWAY IMPACTS

The movement of freight is a crucial component of the role played by the nation's highway system. As the nation continues to see rising VMT, although at slower rates than the past, and suffers insufficient road capacity, the effect of traffic on trucks and of trucks on traffic will generate key social, economic and safety concerns. Much of the focus of freight interaction with passenger traffic is on the National Highway System, NHS, and particularly the Interstate System. The NHS carries 44% of total VMT and 75% of truck VMT. Table 3 provides an important sense of scale. While the focus of this discussion is largely keyed to the intercity component of travel it should be recognized that trucks are significant contributors to congestion and delay in urban areas. Estimates of delay in urban congestion indicate that almost a million hours of delay are generated by on street parking of delivery trucks where off-street parking is not available. The safety implications of the interactions of these vehicles with the traffic stream are clear – more low-speed truck-car crashes. Further, as the intercity and urban components of traffic flows, particularly of trucks, compete for road space around the beltways of metropolitan areas, and commuter peak periods expand to substantial hours of the day, the truck-passenger car friction becomes more of a national issue.

Table 6. Share of VMT by Road System¹²

	Interstate System	Balance of NHS	Other Highways
ALL VEHICLES	35%	30%	35%
ALL TRUCKS	49%	26%	25%
LONG DISTANCE FREIGHT HAULING TRUCKS	75%	20%	6%

¹² Freight Story 2008, FHWA 2008

FHWA estimates that, given their length and operating characteristics, when trucks reach 25% of the traffic stream they become a dominant factor in facility travel characteristics. In 2002 trucks were 25% of average daily traffic on 31,000 miles of the NHS, about 20% of the system, and are expected to reach that level on 37,000 miles of the system by 2035. Highway segments with trucks exceeding 25% of the traffic stream and with more than 10,000 trucks per day are forecast to be greater than 14,000 miles, an increase of almost 230% from 2002 to 2035. By definition, these are among the most heavily traveled segments of the nation's road system.

Safety Implications

The growth in share of trucks on the road system will tend to contribute to higher accident potential situations if only given the disparate operating characteristics of the passenger and truck fleet. If these crashes involve deliveries, they are likely to be at lower speeds and thus less severe. However, if the crashes occur at highway speeds, crash severity will increase. This may be exacerbated by the increasing trend toward smaller and lighter passenger vehicles as part of energy/environmental concerns. At some stage, at least in some corridors, the case begins to be made for complete separation of the operating fleets.

OVERALL SAFETY PATTERNS AND TRENDS

The nation has benefited from declines in freight related fatalities and crashes just as it has in regard to passenger travel. For the most part the truck-related fatalities tend to be passenger vehicle users interacting in crashes with trucks. Large truck occupant suffered approximately 800 deaths in 2007 well below the deaths in the 80's but worse than the 700 registered in 1990 and the 750 in 2000. But the non-truck occupants killed in crashes with trucks numbered just above 4000 in 2007, approximately 10% of which were pedestrians. Non truck occupant fatalities, therefore, were five times that of truck occupants, but also showing a downward trend, as shown in Figure 21. The decline in the fatality rates for passenger cars and large trucks were approximately the same in percentage terms from 1980 through 2007. However, truck-related fatal crash rates per mile continue to be almost twice the overall fatal crash rate.

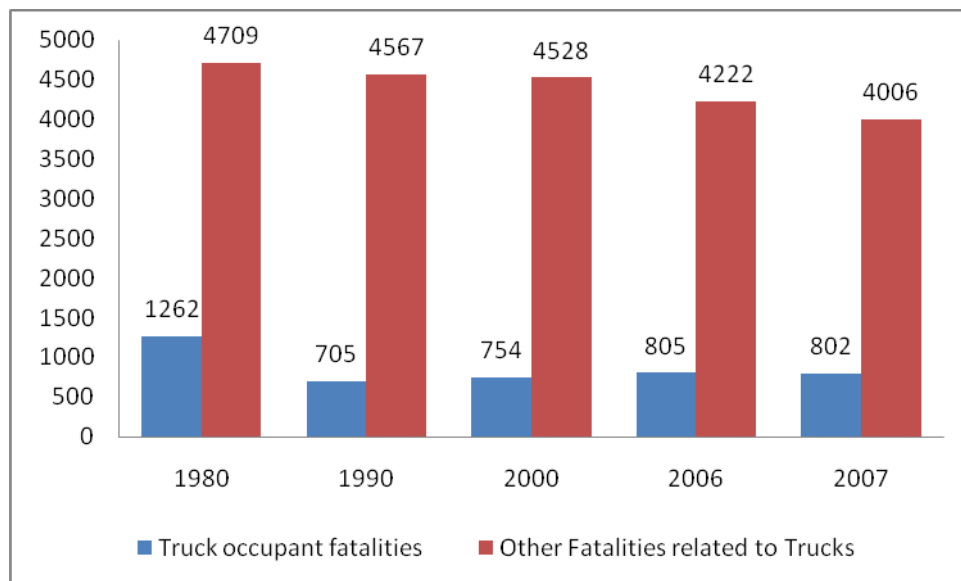


Figure 21. Graph. Truck related fatality trends

Highway related hazardous materials incidents have not shown a similar improvement. All transportation related hazardous materials incidents increased by about 22% from 1980 to 2007. Trucking, which accounted for 90% of such incidents in 1980, increased slightly more slowly at 19% and therefore its share declined to 88% of all such incidents.

Safety Implications

While the trends suggest substantial success in reductions of trucking fatalities paralleling the trends in passenger vehicles over the past decade or more, it is still the case that truck fatality rates are substantially higher than the passenger car rate due to their size. As noted in the earlier discussion of Travel Behavior, it can be hypothesized that the current decreasing trend will bottom out under the “business as usual” scenario and will increase with VMT at some point in the next two decades. If this occurs, it is clear that the patterns in the fatalities of non-truck occupants are critical and need intensive responsive. The hazardous materials trend also gives cause for great concern.

SUMMARY OF “NON-TREATMENT” FACTORS

Rarely in recent decades has the outlook been so murky regarding where America is headed demographically, economically and socially. The primary issue is to disentangle what in recent societal events are short term reactions to economic stresses the nation and the world has faced, and what, in fact, are harbingers of longer term, more sustained trends. The coming decade will be fraught with change in terms of recovery from present negative conditions and with an undercurrent of change rivaling the decade of 1910-1920 a century ago, which was among the most significant sources of change in American history.

Among the, sometimes dramatic, patterns affecting the future:

- A replacement labor force of unknown size and skills
- A rapidly aging population with increased dependency on the working age population
- A population structure heavily determined by immigration policies and realities
- Sharp prospective changes in transportation's energy structure and attendant costs
- The advent of new technologies that may modify transportation needs and capabilities
- Shifts in environmental problems and concerns
- All affecting and being affected by possible changes in societal tastes and preferences.

Transportation planning and transportation safety planning will be forced to be flexible and responsive to change as these forces play themselves out over the coming decade and beyond.

Beyond the implications of greater work travel by those 65 and over, there are the broader questions of how mobile will this generation be and what form their mobility might take. Among the pertinent realities are these:

- This is the most mobile generation in our nation's history. They will undoubtedly carry that behavioral pattern into their post 65 stages of life, including their vehicle ownership patterns.
- The key question will be the extent to which the wealth will be there to support the high activity leisure/retirement life-style that was anticipated just a few years ago, or whether financial constraints will force modified life-styles for those retired, in addition to the pressures to remain at work.
- If the means are there this will engender the heyday for domestic tourism. With the discretionary means and time to engage in travel this could mean an explosion in long distance travel much of it by car/van. Long distance travel data are weak, but a reasonable estimate indicates that as much as 25% of VMT is generated by trips over 50 miles.¹³
- A further factor will be the expected locations of those over 65. Will they forego their present life-styles and opt for apartments in more urbanized settings as some foresee, or continue the historical pattern of aging in place.
- An important ameliorating set of factors will be the intersection of more sophisticated medical services and healthy life-style practices in general and the advent of more capable assisting technologies in road use and vehicles.

The changes in transportation predicted to occur between now and 2030 are complex. Their potential effects on safety are not only complex, but sometimes contradictory. A summary of these effects is presented in Table 7. While difficult to combine due to overlap

¹³ Author's analysis, 1995 ATS, Bureau of Transportation Statistics

of populations covered by the different factors, one might expect an overall increase in the numbers of crashes, fatalities and injuries (if the hypothesized crash rate “bottom” is reached and exceeded).

Table 7. Predicted changes in non-treatment factors, transportation, and safety.

Factor	Expected Change	Effect on Transportation	Effect on Safety
<i>Demographics</i>			
Pre labor force (≤18 years old)	Modest (non-immigrant) growth; most growth in 5-13 year olds; very small growth in 16-18. (See “Immigration” below.)	Increase in school and trips to serve 5-13 year olds.	Limited effect. Increases in GDL could result in decreases in fatalities and injuries for 16-18 year olds.
Labor force (18-64 years old)	Much slower growth than today; work force will be younger; more women in work force; more 50-64s will not retire.	Perhaps less growth in VMT; more trips and chain-trips by women; more work driving by 50-64s.	Slow VMT growth may mean less crash injuries; crashes may decrease and be less severe since women have lower crash rate and are less likely to use motorcycles or bicycles.
Post labor force (> 65 years old)	Large growth in 65-84 year olds; significant growth in the number continuing to work;	Significant growth in miles driven by both male and female 65+ drivers.	Possible increase in overall crashes if 65+ crash rate per mile is higher; probably increase in raw number of fatalities for this group given “frailty factor.”
<i>Household Size</i>	Continuing trend to more households with fewer members	Possible more trips (higher VMT) at lower speeds and with lower vehicle occupancy	Insignificant effect
<i>Immigration Factors</i>	Significant growth in immigration; very volatile levels and patterns	Will increase use of transit, car-pooling, bicycling initially, then auto trips	Increased bicycling could increase serious and fatal injuries; as auto trips increase, the <i>possibly</i> higher crash rate could result in increases in fatalities and serious injuries. Culture factor can be negative factor for crash rates
<i>Licensing and Vehicle Ownership</i>	Continued decreased licensing for 16-17 year olds; increased household vehicle ownership for Hispanics and African-Americans; longer vehicle-fleet	Decreased VMT for 16-17 year olds; increased VMT for Hispanics and African-Americans; increased time to	Decreased 16-17 year old crashes, injuries and fatalities; possible increases in crashes, injuries and fatalities for Hispanics and African-Americans; possible increase in crashes and crash severities with slower

	replacement cycle.	replace old fleet with new cars.	influx of new car safety technologies.
<i>Travel Behavior and Activity</i>			
Future economic activity	GDP will increase annually by 2.4% and VMT by 1.7%.	Increase in VMT	Wealthier population with different trip preferences Increase in crashes, injuries and deaths (assuming crash rate “bottom” has been exceeded)
Household spending on transportation	Continued growth at 2007 level or above	Increase in VMT	Increase in crashes, injuries and deaths (assuming crash rate “bottom” has been exceeded)
Long-distance travel	If GDP growth is sustained, a great increase in leisure travel by the older population can be expected	This can add to the amount of travel by the older population on long distance trips	Potential increases in high speed crashes on interstates and NHS facilities with great fatalities
Housing and location preference	Limited success of urbanization will generate some greater pedestrian and bicycling travel; Major trend will be broad suburbanization patterns typically in large metro areas	Increased interactions between vehicles, pedestrians and bicycles; Significant part of VMT increase will be in suburban trips	Increases in fatalities and serious injuries if pedestrian and bicycle crashes increase; crashes could be more or less severe depending on the speeds on suburban roads.
<i>Truck Freight</i>			
Future truck movements	Truck VMT expected to increase approximately the same as overall VMT. Required new drivers could affect overall driver skill level	Increase in truck VMT; increase in less-experienced drivers	Increase in crashes, injuries and deaths (assuming crash rate “bottom” has been exceeded); new drivers could increase actual crash rate per mile resulting in even greater increases.
Highway impacts	Increased truck-related congestion on higher speed roads and in urban delivery locations	Increased interactions between trucks and small vehicles	Increased crashes, perhaps lower severity in delivery areas but higher severity on freeways and other NHS roads.

FUTURE VIEW OF ROADWAY SAFETY MANAGEMENT UNDER A ZERO DEATH GOAL

The preceding discussion has focused on factors that will affect the future level of safety, but which are not under the control of the safety establishment. This section concerns a factor that can be controlled – safety management under a Zero Death goal.

If the U.S. is to effectively move toward the goal of Zero Deaths, two things are imperative – that adequate levels of funding be available and that the funding – whatever the level – be used as efficiently and effectively as possible. Just as is the case with all health-related disciplines, safety program and treatment/countermeasure decisions¹⁴ will need to be made by very knowledgeable managers who will base their decisions on the best science available. This will require managers who are well-educated in safety science and who are dedicated to making (often difficult) decisions based on what is really known to be effective as opposed to what we think (or hope) will work based on existing program bureaucracies, “common sense,” public demands, political winds, or other non-science-based influencers.

SAFETY PROGRAM FUNDING

Issues of funding will arise at the federal, State and local levels and have two components – the actual level of safety funding and restrictions or specifications on its use

Federal Level

There will be a clear need for both NHTSA and FHWA to be provided adequate funding to both oversee implementation programs and to conduct the research necessary to enhance existing treatments or to develop critical new ones. As shown in the introduction section of this paper, under the level of funding since 2005, it appears that safety treatments have continued to hold constant or slowly reduce the number of fatalities and crash injuries. However, if the economy improves leading to increases in VMT, the decreases for 2006-2009 are likely to disappear. The large annual decreases needed to approach a Zero Death goal will require increased DOT safety budgets. At a minimum, some consideration might be given to defining the 2009 funding level for the three federal agencies as the “baseline”, and then linking minimum increases in DOT annual safety budgets not only to inflation but to increases in road users – both VMT for motorized users and miles of travel by non-motorized users (i.e., pedestrians and bicyclists). While the former is currently being estimated, estimating use by non-motorized users will require new estimation/prediction methods.

There will also be a need to insure that all potential safety funding is used for safety. Currently, State DOTs can divert up to 50% of their Highway Safety Improvement Program (Section 148) funds to other (non-safety) core highway functions. If we are to move toward Zero Deaths, this diversion should be discontinued.

¹⁴ Note that in this section, the terms “safety programs,” “treatments” and “countermeasures” are used interchangeable to depict safety-related actions implemented to reduce crash fatalities and injuries.

Adequate funding refers not only to the Congressionally-budgeted amount, but also to designations or restrictions placed on it by Congress. The effects of Congressional earmarking of research funds in the safety area has been discussed in TRB Special Report 292⁽²⁾ – that it results in a lack of open competition and peer review, awards funding to either unqualified or less qualified researchers and directs funding to areas other than the most important ones, all of which affect research quality. Earmarking (or program designation) also affects program implementation by directing dedicated funding to specific program areas. Often, these programs (and Congressional earmarks) are the result of lobbying by strong advocacy groups. At times, the programs funded have a less than strong scientific basis when compared to other treatment needs. Recent examples include continued funding for railroad grade crossing programs and for motorcycle education and motorcycle awareness programs directed at drivers of other vehicle types. While these programs may well warrant funding, the decision should be based on the potential payoff of the treatment as compared to other treatment areas. However, when compared to the crash harm resulting from many other crash types, railroad crossing crashes should be a much lower priority. Of the 34,017 fatal crashes in 2008, only 153 involved a railroad train – less than one-half of one percent of the fatal crashes. While motorcycle fatalities and crash costs are rising, there is little evidence that any type of “awareness” program has any effect on the driving behaviors or either motorcyclist or non-motorcycle drivers who might crash into them.⁽³⁾ There is also little evidence that the motorcycle education programs we have today change motorcyclist behavior.⁽⁴⁾ There is ample evidence that motorcycle helmets reduce fatal and serious injury and that helmet laws increase helmet use, but this was not a target of the earmark, likely due to strong lobbying against it.

Thus, to reach a Zero Death goal, Congress must allow the DOT agencies to fund those areas that are expected to have the greatest benefit. This is a very difficult objective, since first, DOT funding appears to be one of a limited number of federal program areas where earmarking is possible, and second, because the feeling is that no one tells Congress what to do. Clearly, this will require self-policing by Congress and perhaps more program-based (as opposed to budget-based) interaction between DOT staff and Congressional staff or members and more Congressional contact by politically-strong safety organizations (e.g., AASHTO, GHSA).

Given flexibility in funding, the three DOT agencies should then develop and use data-driven methods to choose which programs would be the highest priority for implementation. As noted later in this section, the DOT agencies would then use this information to determine whether implementation programs proposed by the State and local agencies safety agencies are acceptable. The DOT agencies are currently moving toward a data-driven approach. For example, the Office of Safety is experimenting with various methods for choosing “focus states” for supplemental funding efforts. These methods should continually be examined and improved. Research aimed at developing methods to produce a prioritized list of research areas – a national research agenda – are currently being developed as part of NCHRP Project 17-48, “Highway Infrastructure and Operations Safety Research Needs.” A comprehensive analysis framework for safety investment decisions across engineering, education, enforcement, and emergency medical services is currently being developed in NCHRP Project 17-46. The three DOT agencies

should carefully examine the results of these two efforts and implement those that can increase the efficiency and effectiveness of their funding decisions. As discussed in the next section, the critical issue will be the DOT agencies' ability and willingness to direct State and local programs to such a data-driven decision process.

State Level

The level of State safety funding is driven to a significant extent by Congressional decisions and subsequent decisions by FHWA, NHTSA and FMCSA. However, there is significant flexibility in both roadway and driver-related areas (e.g., Highway Safety Improvement Program and 402 programs) to allow States to direct funds to their greatest needs. To move toward Zero Deaths, these needs will have to be based on where funding will lead to the largest decreases in deaths and injuries. These decisions will need to be made with processes based on such factors as estimated problem size, treatment effect and cost rather than on past levels of funding to existing bureaucracies, areas, public pressure, or other factors.

There are existing tools or tools soon to be available that can and will help in these decisions. The NCHRP Project 17-46 safety investment framework will be designed to be applicable at the State level. In addition, on the driver side, there is a continuing series of updated information concerning "Countermeasures that Work".⁽⁵⁾ These provide detailed information on the estimated effectiveness (using a star rating), level of current use, cost level and implementation time requirements for a large variety of countermeasures that can be implemented by State Highway Safety Offices. On the roadway side, FHWA has developed the Interactive Highway Safety Design Model (IHSDM) which can be linked with CAD (Computer Aided Design) software to estimate the level of safety (i.e., crash and crash severity level) for roadway design and rehabilitation alternatives, and SafetyAnalyst, which aids the user in identifying roadway locations which most need safety treatments and in determining which of the treatment alternatives would be most cost-effective. SafetyAnalyst has been turned over to AASHTO for marketing and maintenance. Both these tools are included in AASHTO's soon-to-be-released *Highway Safety Manual* – a compilation of safety knowledge and safety tools designed to aid the roadway safety engineer in decision-making. Finally, while not as specific with respect to effectiveness level as the upcoming *Highway Safety Manual* will be, the NCHRP Series 500 Guide series contains detailed information on a large number of both driver countermeasures and roadway treatments categorized both by program areas (e.g., run-off-road collisions; increasing seat belt use; heavy truck crashes) and by whether the individual treatment is "proven," "tried" or "experimental."

All of these resources can help lead to a data- and science-driven decision process. The critical issue will be whether the tools are used. The States currently prepare a series of planning documents (e.g., the Highway Safety Improvement Plan, Strategic Highway Safety Plan, annual Highway Safety Plan) which are reviewed by FHWA and NHTSA. To move toward Zero Deaths, each State plan will have carefully define its needs and focus funding on treatments/countermeasures that have proven to be effective by sound evaluations. This will likely require more effort in the problem identification phase in some States and may well decrease or eliminate funding to some traditional program areas. These will be

difficult decisions, but ones that will need to be made at both the State and Federal level. Under the current federal legislation, the consensus is that while they review the plans and provide input, neither FHWA nor NHTSA has the power to actually reject a poor plan, or even if there is an adequate plan, to force a State to demonstrate significant progress toward the goals stated. It appears that this may change in the upcoming federal legislation. Both agencies may be given more power with respect to turning down inadequate plans and requiring States to redo them. There will also be penalties for States that don't make adequate progress toward their plan goals (e.g., losing the authority to flex core highway funds between programs). If given these increased powers, both FHWA and NHTSA will then need to use them to force the use of better methods and sound treatments. This will require a developed policy concerning what countermeasures and treatments are acceptable and high priority and will lead to decisions that are likely to be politically difficult. Again, if we are to move toward Zero Deaths, such difficult decisions will be necessary.

While a high percentage of the State safety funding would need to be focused on the high-priority proven treatments noted in the last paragraph, there will undoubtedly be cases where States want to fund "experimental programs" – either new treatments or treatment that do not yet have a known level of effectiveness. If managed correctly, this would provide an opportunity to learn whether such programs are effective. For such countermeasures/treatments, it may be possible to require that part of the submission be a scientifically-sound evaluation plan. Since evaluation is best done when planned (and often initiated) before implementation (e.g., allowing choice of treatment and comparison/reference sites or groups of road users), this would insure that the "experiment" provides knowledge regardless of whether the outcome is positive or not.

Finally, while it was noted above that what is normally thought of as "safety funding" is often limited to the federally-funded dollars (e.g., Section 402, HSIP, etc.), a significant amount of additional moneys are spend on both roadway and driver safety. On the driver-side, decisions concerning significant safety-related funding are made within driver licensing agencies, enforcement agencies, court systems, emergency medical services advisory groups and by others. On the roadway side, decisions made which concern roadway design and roadway maintenance can greatly affect safety. To move toward Zero Deaths, State safety "leaders" will need to leverage the "normal" safety funding by being involved to the extent possible in critical decisions by these other bodies. Such interagency coordination and cooperation is clearly occurring now in some States. Such efforts will need to be increased if we are to move toward the Zero Death goal. This will require funding, political skill and the backing of upper-level administration.

Local Level

With the exception of their own funds (e.g., local enforcement, local EMS), local level safety funding would be expected to continue to be decided by the State Highway Safety Office and State Division of Highways. Again, decisions by the State agencies on what programs would received funding should follow the same data-driven guidelines noted in the preceding sections – concentrate funding on those programs that are proven effective and will affect a significant number of fatalities and injuries.

There is a current roadway-related issue that needs some discussion – the funding of local road safety projects. Will there be a continuing trend to combine management of both state system and local roads and how will this affect the level of safety on both? More specifically, if the State DOTs are required to increase expenditures on local roads in the absence of increased safety funds, will this lead to a decrease in safety on state-system roads? As shown in Table 5 below, using 2008 FARS and Highway Statistics data, only 20.3% of the total mileage in the U.S. is owned by State DOTs, and these are often the busiest roads in America, but they also have 57.9% of the fatalities occur on this mileage.. While 41.6% of the fatal crashes are on local roads, 79.7% of the mileage is there. Thus, if States are to expand their responsibility to local roads for roadway based treatments, there needs to be both a significant increase in total safety treatment funding. In addition, targeting treatments to this large number of local miles once again reinforces the need to use the best targeting tools available (e.g., SafetyAnalyst). Unfortunately, some of the data required by SafetyAnalyst will not be available for these roads, perhaps leading to the need for a “local-road reduced-data” version of that software.

Table 5. 2008 Fatal crashes and highway mileage percentages (From FARS and Highway Statistics).

Ownership	Rural		Urban		Total	
	% Fatal Crashes	% Mileage	% Fatal Crashes	% Mileage	% Fatal Crashes	% Mileage
State Highway Agency	63.3%	22.6%	51.8%	14.2%	57.9%	20.3%
Local (County, Town, Municipal)	36.7%	77.4%	48.2%	85.8%	41.6%	79.7%
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

SAFETY PROGRAM MANAGERS

The decisions above will require very knowledgeable safety managers. Developing and retaining such managerial experience over next two decades will be difficult. This may be particularly true at the State level. On the roadway side, there appears to currently be a dedicated group of State “safety engineers” that represent some but not all States. An issue here concerns the aging of this group and the issue of how knowledgeable their replacements will be and whether these managers (the front-line “implementers”) will be trained and educated sufficiently. The question is whether all the training will be “on the job” as it appears to be today, or whether there is the need for more dedicated training programs. On the driver side, in addition to the same aging-manager issue, there is also the fact that the highest ranking official – the Governor’s Highway Safety Representative – is politically appointed, sometimes (often?) has little or no safety knowledge or experience and changes with changes in administration. In some but not all States, the actual working

staff is in an Office of Highway Safety with their own Director/Coordinator who is more likely to be knowledgeable, long-tenure administrator. However, at times, Governor's Reps (like all roadway users) have their own ideas about what the best safety programs are and have the political power to have their decisions implemented. The issue here is whether that can be changed – is there training or some other method to insure that the program decisions made lead to the most effective programs? Currently, there is an introductory training program offered by Governors Highway Safety Association for new Governor's Representatives and Traffic Safety Institute training course on specific NHTSA programs, but no “continuing-education” courses for lead administrators.

A management issue that is likely to arise in some States is whether, like other State functions, the operations of roadway and driver safety functions will be out-sourced to the private sector and if so, what the expected effects would be? Outsourcing is often done to save funds. If salaries and overhead are higher in the private sector, would this mean less money for actual treatments, or would the level of personnel be decreased to save salary dollars? Would there be a way to add incentives to outsourced contracts based on actual changes in crashes and injury (as determined by an independent assessment) or on some acceptable surrogate measures of safety improvements (e.g., the use of the latest tools and resources in decisions, increases in the number of proven highly-effective treatment programs implemented)?

Finally, to move toward the goal of Zero Deaths, there is a need for all aspects of the safety program to become more “holistic” in nature – both a better understanding of what other components of the safety program do and more cooperation in the development and implementation of the total program. At the federal level, it appears to this observer that while FHWA and NHTSA staffs are more in touch than in the past, there are program areas where maximizing effectiveness and efficiency may require even tighter connections. Obvious areas are those where overlapping responsibilities exist – the pedestrian and bicycle activities, speed management efforts, and indeed the review of State Strategic Highway Safety Plans and annual Highway Safety Plans. At the State level, the development of the SHSP and the HSIP is now requiring integration, but both are still developed primarily by different organizations. As noted above, on the roadway side, there will be an increasing need to insure that all decisions which affect safety are coordinated, meaning that roadway design and roadway maintenance decisions are made with the inputs of the State Safety engineers who are often in the traffic engineering area.

FUTURE SAFETY MANAGEMENT – SUMMARY

To move toward a Zero Death goal, safety management at all levels must become as effective and efficient as possible. The above text has noted the following recommendations that the authors feel should be considered.

- Consider linking minimum increases in FHWA, NHTSA and FMCSA annual safety budgets to not only inflation, but also to increases in road users – both VMT for motorized users and miles of travel by non-motorized users (i.e., pedestrians and bicyclists).

- Protect all existing safety funds by no longer allowing State DOTs to divert up to 25% of their Highway Safety Improvement Program funds to other (non-safety) core highway functions.
- Congress must allow the U.S. DOT agencies to fund those areas that are expected to have the greatest benefit, eliminating earmarking. This will require self-policing by Congress and perhaps more program-based (as opposed to budget-based) interaction between DOT staff and Congressional staff or members and more Congressional contact by politically-strong safety organizations (e.g., AASHTO, GHSA).
- Given increased flexibility in non-earmarked funding, the three U.S. DOT agencies should then develop and use data-driven methods to choose which programs would be the highest priority for implementation.
- Programs/treatments/countermeasures chosen at the State level must be those that will lead to the largest decreases in deaths and injuries. The decisions will need to be based on estimated problem size, treatment effect and cost rather than on past levels of funding to existing bureaucracies, areas, public pressure, or other factors. Difficult political decisions will have to be made. There are both driver and roadway safety tools available to strengthen these decisions. Their use should be required.
- If given increased oversight power by new legislation, FHWA and NHTSA should use this to insure that State safety plans are data-driven and focused on treatments that will lead to the greatest reduction in deaths and injuries, rejecting or requiring modification of those plans that do not meet these criteria. Difficult political decisions will have to be made.
- If States propose funding treatments/countermeasures whose effectiveness is unknown, consider requiring that a scientifically-sound evaluation be planned, funded and conducted as part of the treatment.
- State safety driver and roadway administrators will need to leverage the “normal” safety funding by increased involvement in safety-related decisions made by other “non-safety” agencies (e.g., driver licensing, enforcement, EMS, roadway design and maintenance, etc.) This will require funding, political skill and the backing of upper-level administration.
- Expanding State roadway safety responsibility to local roads could decrease treatments on the higher-crash State system in the absence of increased funding. Given the large number of local miles, new targeting methods may need to be developed.
- Both driver and roadway safety managers are “aging out,” and there is only limited “continuing education” training available for their replacements. New training programs should be considered.
- Careful study will be needed of any move to “out-source” State safety functions. If such out-sourcing is done, consider contract incentives based on actual changes in crashes and crash-injury as determined by an independent assessment.

CLOSURE

As noted in the Introduction, the nature of future transportation will be decided by a large and complex group of factors. Predicting how each will change between 2010 and 2030 is a difficult and risky task. In like fashion, how these changes in transportation will affect crashes, injuries and fatalities is also difficult to estimate, even for relationships that appear as straightforward as VMT and crashes. The preceding sections have presented the authors' opinions on those factors we consider most important to the future of safety. These can clearly be argued with. However, it is difficult to argue that crashes, fatalities and injuries will continue to decrease as they have for the past two to three year period. If so, then given the 3,000 to 4,000 deaths per year decrease we have seen, we will reach our Zero Death goal by 2020 or so. It is much more likely that as the economy recovers and VMT increases, crashes, injuries and deaths will once again increase under a "business as usual" scenario.

If we are to reach or even see significant movement toward a true Zero Death goal, the safety community will need to recognize that travel demand and travelers will be different in the future. It will need adequate resources, and will need to manage those resources even better than we are today. It will need to identify and implement programs, treatments and countermeasures that produce the largest safety benefit per dollar spent. This initial whitepaper has tried to provide a background for the level of safety we will see over the next two decades if we change nothing, and has provided recommendations concerning how safety management can be improved. The papers that follow will focus on identifying the select group of treatments and countermeasures that the safety community will need to implement if Zero Deaths is more than just a slogan.

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